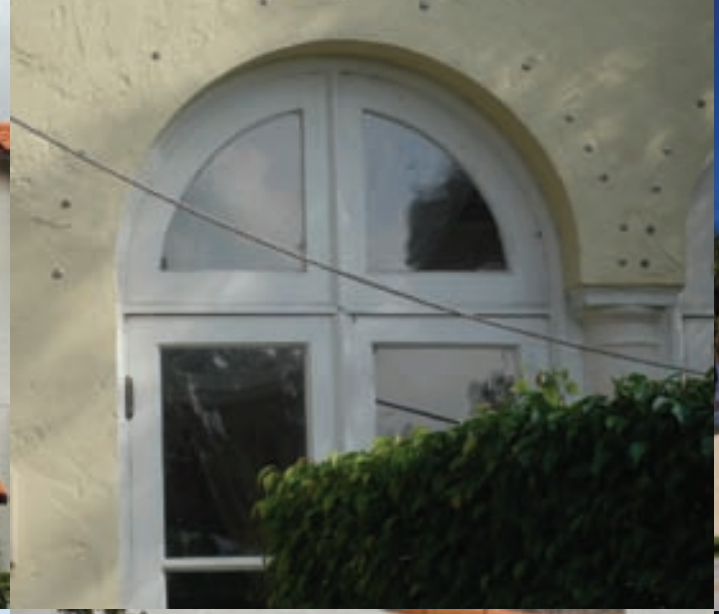

Disaster Mitigation for Historic Structures: Protection Strategies

PREPARED BY 1000 FRIENDS OF FLORIDA
FLORIDA DEPARTMENT OF STATE, DIVISION OF HISTORICAL RESOURCES; FLORIDA DIVISION OF EMERGENCY MANAGEMENT

DISASTER MITIGATION FOR HISTORIC RESOURCES: PROTECTION STRATEGIES

Prepared by 1000 Friends of Florida on behalf of the Florida Department of State, Division of Historical Resources and the Florida Division of Emergency Management

AUGUST 2008

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This publication has been funded in part with grant assistance provided by the Florida Department of State and Florida Division of Emergency Management. It was prepared by 1000 Friends of Florida with input from the Technical Advisory Committee. The contents and opinions do not necessarily reflect the views or opinions of the Department of State or the Florida Division of Emergency Management, nor does the mention of trade names or commercial products constitute their endorsement or recommendation.

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Table of Contents

Guiding Principles....PAGE 1

Introduction....PAGE 1

General Mitigation Requirements....PAGE 2

SECTION 1: Florida Building Code and Product Approval....PAGE 3

- Florida Building Code....Page 4
- Florida Building Code Flowchart....Page 5
- Flexibility Afforded Historic Structures Chart....Page 6
- Product Approval....Page 7

SECTION 2: Questions to ask when considering what mitigation option may be appropriate for a historic building....PAGE 8

- Checklist....Page 12

SECTION 3: Categories of Mitigation options....PAGE 16

- Roofs....Page 16
- Windows....Page 21
- Doors....Page 32
- Garage Doors....Page 36
- Porches....Page 39
- Walls & Foundation....Page 43

SECTION 4: Products....PAGE 47

- Metal Roofs....Page 48
- Tile Roofs....Page 50
- Shingle Roofs....Page 53
- Hurricane Straps/Clips....Page 55
- Hurricane Screening/Fabric....Page 56
- Roof Straps or Harnesses....Page 57

SECTION 5: List of Certified Local Governments....PAGE 58

GUIDING PRINCIPLES

Hazard Mitigation: Any action to reduce or eliminate long-term risk to life and property from any hazard.

Retrofit: Change to an existing structure to protect it from hazards, such as floods, high winds, or earthquakes.

When considering measures to improve resistances to storm damage, historic building owners should keep in mind that the materials, products and systems routinely used in retrofitting ordinary structures are not always appropriate for a historic building. When adopting protective measures, historic structures need special considerations. Disaster mitigation must be weighed against the overall objective of preserving the historic integrity of the structure. There may not be a simple fix for a historic structure – compromise is often a part of the solution and a variety of solutions may be considered before one or more are selected because they have the least effect on the historic fabric and character of the property. Also, as technologies evolve and the hazard mitigation industries better respond to the special needs of historic properties, products considered acceptable today may be superceded by new more efficient products that have less visual and physical effect on the property, allowing an opportunity for development of an improved mitigation plan. For this reason, it is advisable to consider the reversibility of any mitigation treatment when determining which one to use. Owners of historic buildings should limit mitigation measures to those that achieve reasonable protection, at reasonable costs, with the least intrusion or impact on the historic materials, features or character of the building. Overzealous mitigation, which introduces the risk of damage to historic building materials, should not be undertaken.

INTRODUCTION

This manual is a continuation of coordinated work between the Florida Department of State, Division of Historical Resources, the Florida Division of Emergency Management and 1000 Friends of Florida to improve the integration of historic preservation and disaster preparedness. This joint agency project previously produced a manual entitled "Disaster Planning for Florida's Historic Resources" which identified a number of steps that communities can take to prepare for a disaster and minimize its impacts on historic resources. As a follow up, this manual's focus is on actual mitigation options for individual historic structures.

Specific mitigative improvements that can be applied to historic resources without diminishing the historical integrity of the individual structure are discussed in this publication. These mitigation methods were identified and evaluated by a Technical Advisory Committee of historic preservation and emergency management professionals, architects, building code officials, manufacturer/industry representatives and a testing lab engineer. The result is the identification and documentation of materials, systems, products and installation techniques available to address the specific mitigation needs of historic structures. It is intended that this information be made available to building departments, preservation review boards and individual owners, and that it will result in improvements that avoid compromise to the historic integrity of individual structures, neighborhoods and traditional commercial centers. It is also intended that this manual will make the selection of appropriate mitigation solutions for historic properties easier and more timely, allowing improved acess to mitigation funding opportunities, such as Hazard Mitigation Grant Program funds. In addition to furthering the objectives of the State Mitigation Plan, this manual will also assist local public and private mitigation efforts. Local mitigation strategies include a list of mitigation projects and are beginning to incorporate historic preservation as an integral issue.

The four hurricanes of 2004 created an estimated $22 to $23 billion in losses in Florida. A reduction of excessive losses from disasters through preparedness and mitigation will substantially enhance community resiliency and economic sustainability. Not only do historic resources help to define our state's character, they play an important economic role at the state and local levels. The level of interest in protecting Florida's historic resources is growing. Through better protection of these resources, potential damage can be reduced, thus helping in economic recovery and restoration of tourism, one of the state's biggest industries.

Thank you for utilizing this manual to protect Florida's historic structures. Whether you are a property owner, planner, building industry professional or volunteer, your participation in both historic preservation and disaster mitigation is important to preserving the unique historic resources of our state.

GENERAL MITIGATION REQUIREMENTS

The following guidance is consistent with the recommended preservation approaches for historic buildings as set forth in the *Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings (Standards and Guidelines),* which are online at **http://www.cr.nps.gov/hps/tps/tax/rhb/index.htm.** This publication may also be obtained from the Florida Department of State, Division of Historical Resources by calling 1-800-847-7278 or 850-245-6333. These Standards and Guidelines provide the basis for all reviews conducted by Florida Division of Historical Resources of state-funded and federally-involved projects affecting historic properties. They are also integral to the vast majority of local historic preservation ordinances in Florida and across the nation. The objective of the Standards and Guidelines is to minimize alteration, damage or loss of those elements that characterize a historic building.

The following preservation priorities are applicable to improvement projects affecting historic properties:

1) *Retain and protect*
2) *Repair* as needed; and
3) When condition warrants, *remove and replicate* historic materials and features such as windows, doors, porches, roofs, eaves, foundations, siding, trim and finishes.

Generally, an acceptable retrofit improvement for a historic building is one that:

1) Is concealed from view,
2) Does not change the appearance of existing materials or historic features,
3) Avoids removal and replacement of historic features, and
4) Protects historic windows and doors during storm season in an unobtrusive manner.

"Unobtrusive manner", means that the mitigation option minimizes loss or change in appearance of original materials and features, but may vary based on the duration and type of mitigation option being used. For instance, a temporary solution such as a flexible wind abatement system would be in place for only a few days. The temporary solution's appearance may not matter, as long as the installation is appropriate, meaning that the installation doesn't damage the historic fabric of the structure. Another possible solution may involve the seasonal installation of system tracks or channels that are intended to received a protective panel system when a hurricane watch or warning is issued. Likewise, this installation shouldn't impact the historic fabric and the visual impact is temporary. A permanent solution should utilize a system that is unobtrusive both visually and physically, such as hurricane clips installed in the attic or concealed beneath siding or historic trim.

When retrofitting a historic building, it is ideal to replace in kind. Meaning that if replacement is necessary, use items that match the original in design, size and materials. Because damaged elements may not necessarily have been original to the building, research into the structure's original design will provide important information for retrofit alternatives. Historic photographs, physical evidence, and even materials found in attics can hold clues to the original design elements. Local historical societies, archives, and preservation organizations may have historic photographs. The Florida Photographic Collection may be a helpful on line resource as well: **http://www.floridamemory.com/PhotographicCollection/index.cfm**. Many Florida communities have a Historic Preservation Officer or planner on local government staff. These professionals may be able to provide guidance and connections to local resources. Some municipality or county governments participate in the Certified Local Government Program (CLG). The purpose of the CLG program is to link the federal, state, and local governments into a preservation partnership for the identification, evaluation, and protection of historic properties. CLG designation makes historic preservation a public policy through passage of a historic preservation ordinance. A list of CLGs may be found in the back of this manual. Also, the assistance of a professional architect or contractor seasoned in preservation projects is important for extensive mitigation plans to historic structures.

Section 1:

FLORIDA BUILDING CODE AND PRODUCT APPROVAL

Photos Courtesy of (A) Florida Trust for Historic Preservation, Inc.; (B) REG Architects, Inc.; (C) Manausa Lewis & Dodson Architects; (D & E) 1000 Friends of Florida

FLORIDA BUILDING CODE

Stemming from the severe hurricane damage experienced throughout Florida in the 1990's, a single building code for Florida was adopted in 2002. The *Florida Building Code* is based on national model building codes and standards but has been tailored to meet Florida's specific needs, particularly in the areas of wind and water impacts. Since March 2002, the *Florida Building Code* supersedes all local building codes.

The *Florida Building Code* is a compendium of seven main volumes: Building, Plumbing, Mechanical, Fuel Gas, Existing Building, Residential and Test Protocols for High-Velocity Hurricane Zones. The code in its entirety can be found at **www.floridabuilding.org**.
It is updated every three years but can be amended annually to incorporate interpretations and clarifications.

Changes to historic structures must meet the requirements contained in the Existing Building volume. For the purposes of the *Florida Building Code*, a historic building is defined in Section 1102, *Florida Building Code* Existing Building as a structure that is:

- Individually listed in the National Register of Historic Places, or
- A contributing property in a National Register listed historic district, or
- Designated as an individual or contributing historic property by a local, state or special district, or
- Determined to be eligible by the State Historic Preservation Officer for listing in the National Register.

Figure on page 5 (General Overview of Requirements) provides an overview of the primary building code requirements for existing buildings in terms of disaster preparedness. As shown in that figure, code requirements are different for repairs versus alterations. Additionally, the requirements also change for alterations to existing buildings depending on where the building is geographically located within the state. Buildings located in a windborne debris region have to meet additional glazing protection requirements, while buildings in the High Velocity Hurricane Zone (basically Miami-Dade and Broward Counties) must also comply with the more stringent requirements.

Chapter 11 of the Existing Building volume focuses directly on historic structures. This chapter is very important because it provides flexibility to historic buildings when meeting code requirements, in recognition of the need to preserve the character of these buildings. In particular, as shown in figure on page 6 (Overview of Goals, Objectives and Options), it affords the opportunity to use an equivalent system method or device to meet code requirements, if the local building official accepts it. It also allows three options for code compliance – non-historic existing buildings are limited to only two options.

To ensure that the full range of flexibility is applied to work done on an historic building, it is vital to involve an architect with experience dealing with historic buildings and the *Florida Building Code*. The overall goal embodied within Chapter 11 is to continue to maintain and preserve the original space configurations of historic buildings, as well as minimizing the alteration, destruction or loss of historic fabric or design of the structure. Creativity is often required to achieve that goal and meet code requirements.

Florida Building Code (FBC), Existing Building

GENERAL OVERVIEW OF REQUIREMENTS

(Please refer to Florida Building Code, Existing Buildings, for specific requirements

EXISTING BUILDINGS

Repairs
(defined in Section 202 FBC Existing Building)

- Can use original or like materials
- Replacement glazing must meet safety requirements if in hazardous location (def. in Section 2406.3, FBC Building)
- Wind design shall be in accordance with building code in effect when building permitted (Section 506.1.2, FBC, Existing Building)

Alterations
(defined in Section 202 FBC Existing Buildings)

Outside of Wind Borne Debris Region or High Velocity Hurricane Zone

- Generally must meet wind loads for location
- Re-roofing must meet requirements of Chapter 15 (FBC, Building)
- Must meet code requirements if building altered such that it is less safe or energy efficient

* ***Note:*** *Qualified Historic Buildings are exempt from Florida energy requirements (see Section 13101.5.5, FBC, Building)*

In Wind Borne Debris Region (defined in Section 1609.2, FBC, Buildings)

- Must meet same requirements as above
- Additionally glazing must be impact resistant or protected by impact resistant covering:

  For nonresidential or residential more than 3 stories:
  - Within 30 ft of grade, meet Large Missile Test
  - More than 30 ft above grade, meet Small Missile Test
  - Over 60 ft above grade and over 30 ft above aggregate surface roof area within 1500 ft, can be unprotected

In High Velocity Hurricane Zone (Miami/Dade and Broward as defined in Section 202, FBC, Building)

- Must meet same requirements as above
- All external wall components (including all doors and windows) must have specific Product Approval for impact loads or be protected by product approved storm shutters
- All parts/systems of building must meet impact test criteria or be protected with external protection device that does
- Can only use products with Miami-Dade Product Approval
- Have to comply with more stringent High Velocity Hurricane Zone requirements found throughout the Florida Building Code

Flexibility Afforded to Historic Buildings

OVERVIEW OF GOALS, OBJECTIVES AND OPTIONS

(Please refer directly to Florida Building Code for specific requirements)

Historic Building
(defined in Section 1102, FBC, Existing Building)

Must be:

- Individually listed in National Register or
- A contributing property in a National Register listed district or
- Designated as individual or contributing historic property by local, state or special district or
- Determined eligible by SHPO for listing in the National Register

Section 1103.1: Goals

- Maintain and preserve the original space configurations of historic buildings
- Minimize alteration, destruction or loss of historic fabric or design

Section 1103.2: Objectives

- Encourages preservation of original qualities or character of historic buildings and sites
- Incorporates the Secretary of the Interior's Standards for Rehabilitation and Guidelines

Section 1104: Equivalency

- Allows the use of equivalent systems, methods or devices to meet code requirements if technical documentation of equivalency is submitted to building official AND equivalent system is acceptable to building official.

* ***Key:*** *Establish a working relationship with your local building official*

Section 1105: Compliance

- Provides three compliance options: 1) meeting the prescriptive provisions of Florida Building Codes; 2) meeting Compliance alternatives (Chapter 13 FBC, Existing Building); or 3) meeting performance based provisions of National Fire Protection Association 914 *Code for Fire Protection of Historic Structures* (Chapter 6, NFPA 914)

PRODUCT APPROVAL

When researching products to help protect a historic structure from potential damage, you want to make sure that the product will meet code requirements. The products that you may be allowed to use vary based on a building's geographic location. If the property is in Miami-Dade County or Broward County, the product must have Miami-Dade approval or have been approved by the Florida Building Commission for use in a High Velocity Hurricane Zone. In all other areas of the state, a product must simply be approved by the Florida Building Commission.

Both the Florida Building Commission and Miami-Dade Building Code Compliance maintain on-line data bases related to products that have been approved as meeting the code standards. The Florida Building Commission database is available at **www.floridabuilding.org.** Products in seven major categories can be submitted for approval: panel walls, exterior doors, roofing products, skylights, windows, shutters, and structural components. The Product Approval Program Oversight Committee (POC) meets on a monthly basis to review and make recommendations regarding approval of new products or applications.

On the Florida Building Commission website, you can search by a number of different parameters including the manufacturer's name or the category of the product (i.e., shutters, roofing, windows etc.) You can also search for products that have been approved for use in the High Velocity Hurricane Zone, are impact resistant or meet a specific design pressure. "Product Approval" means that the product is approved for use in accordance with the stated terms of approval and limitations of use. That approval is valid until the product changes in a way to decrease performance, or the approval is suspended, revoked, or superseded by a revision to the approval.

Products that carry Miami-Dade approval can be accessed at **www.miamidade.gov/buildingcode/**. The Miami-Dade Building Code Compliance Office is responsible for the product control approval process. Staff reviews the applications and determines if the submittal is sufficient to determine compliance with building code requirements. The final approval determination is made by the Miami-Dade Board of Rules and Appeals. If approved, a Notice of Acceptance (NOA) is issued which constitutes the official approval document and outlines the conditions and limitations under which the approval was given. The approval date and expiration date are shown on the first sheet of the NOA.

As with the Florida Building Commission website, a variety of search parameters can be used to research products. You can search geographically by high velocity hurricane zone or non-high velocity zone. You can also search by the applicant, manufacturer, category (e.g. shutters, roofing), sub category (e.g. bahama shutters or asphalt shingles) or by a specific material. The listings under each of these options tend to be more extensive than in the Florida Building Commission database.

While both databases are easy to access and use, it may take a few search requests to get a feel for how different categories of products are listed. The two databases are not consistent in terms of the search parameters so you may need to explore each database to get the search results that you are seeking. It is very important that you look at the approval certificate itself for each product that you are considering. Just because a product is "approved" doesn't mean that it will be appropriate for use in every case. Every product is tested based on a specific set of application assumptions related to design pressure, installation methodology, product construction and materials. The product is only approved for use consistent with those testing parameters. Thus you need to review the conditions of approval to determine if they meet your situation, particularly in terms of the design pressure used in the test. If they do not, either another product whose testing is consistent with your specific needs should be found or consideration to pursue additional testing could occur.

Section 2:

QUESTIONS TO ASK WHEN CONSIDERING WHAT MITIGATION OPTION MAY BE APPROPRIATE

Photo Courtesy of (A) Laura Lee Corbett Consulting; (B) Koreshan State Historic Site; (C) 1000 Friends of Florida; (D) Phoenix Architectural Products, Inc.; (E) Manausa Lewis & Dodson Architects

QUESTIONS TO ASK WHEN CONSIDERING WHAT MITIGATION OPTION MAY BE APPROPRIATE FOR A HISTORIC BUILDING

1. Is the building designated as an historic resource?

Contact your local historic review board, planning department or historical society/organization, to determine if the building is designated under a local preservation ordinance. These entities may also have information about any tribal or federal designations.

Contact the Florida Department of State, Division of Historic Resources at **fmsfile@dos.state.fl.us** to determine if the building is listed in the National Register of Historic Places. You can also go to National Park Service's website (**www.cr.nps.gov/nr/**) to check on possible National Register listing.

If your building is not designated, go to question 2.

If your building is designated, go to question 3.

2. Is the building 50 years or older? (Or has it been determined to possess exceptional significance if less than 50 years old?)

Buildings that are 50 years old or older may be eligible for listing or designation as an historic resource. Buildings less than 50 years old may be eligible for designation or National Register listing if determined to possess exceptional significance by a local preservation program or the National Park Service.

If yes, please continue with question 3.

If no, but you have an older home, you are encouraged to follow the recommendations in this document to maintain the architectural and historic integrity of the building.

3. Does the local government have any existing standards or requirements for review of historic properties?

Check with the local planning department, building department, historic preservation organization. Many local governments have ordinances which specify a required review process for changes to designated historic properties and have specific design requirements. These can affect the type of mitigation option that can be considered.

4. Is the planned mitigation part of a larger rehabilitation/renovation project or a stand alone project?

Be aware that the range of mitigation options will vary depending on the scope of the overall project. For example, if you are replacing roofing, installation of framing straps and screwing down sheathing should be accomplished. If you are not replacing roofing a bead of adhesive placed on the joint between sheathing and framing will still improve the strength of the roof system. Additionally, a larger budget may allow for the development of a custom solution, as opposed to being limited to looking at existing products.

5. Where is the funding coming from and are there associated design standards that must be met?

Use of state or federal funds (including grant monies), and some permitting processes require a formal review of the proposed changes by the Florida Department of State, Division of Historical Resources, the State Historic Preservation Officer and FEMA. This is in addition to any local approvals that may be needed. These reviews need to be completed prior to the initiation of construction. Contact the Compliance Review Section in the Bureau of Historic Preservation, Florida Department of State, to determine if this review applies to you. Contact information: 850.245.6333 or 1.800.847.7278.

6. Are there resources in your community where you can get professional help with the project?

Check with local historic preservation organizations and local planning staff. Often there are local architects with experience in historic preservation and extensive local knowledge who may be hired to design your hazard mitigation improvements. Additionally some local architects may be willing to provide pro bono services for projects sponsored by local historic preservation organizations or other non-profits. In all cases, however, you need someone who has demonstrated architectural experience with historic buildings so make sure that references are provided.

7. Is the building historic, or does it have historic components?

Mitigation options vary depending on the age and significance of the building feature(s) targeted for protection.

Obviously, changes occur to buildings over time. For example, windows or doors are replaced, roofing materials are altered and porches are added or modified. Early alterations can possess significance equivalent to original features. Consult with the local preservation officer or the state Division of Historic Resources staff for assistance in determining if a specific feature is of historic significance to your property. Materials of construction or manufacture can provide a clue – for example if the building was built in the 1800's of wood and the windows are metal, they are not likely to be original or of historic significance.

If yes, the mitigation option chosen should preserve the historic integrity of the feature.

If no, the mitigation option should preserve surviving significant or character-defining features (for example, surviving original wood window trim) and should be compatible with the historic character of the property.

8. Will the building owner or occupants "activiate" the damage protection measures when they are needed?

It is very important to choose products that match your capability to install or use them. Something that requires a lot of manpower or expertise to close or temporarily install is not a good option if that manpower or expertise does not exist. Be realistic in your projections of the people and resources you will actually have as a storm approaches, and use that as one of the criteria for evaluating different options.

To continue with the analysis, please go to the appropriate section for the feature involved:

- **For Windows, go to Section A**
- **For Doors, go to Section B**
- **For Porches, go to Section C**
- **For Roofs, go to Section D**
- **For Walls, go to Section E**
- **For Foundations, go to Section F**

A. WINDOWS:

1. Is the window or its frame historic?

It is very important to be aware of construction and design details of the window to be protected as these will influence the choices available. Proper installation of the window protection system is key to ensuring that a product functions properly and provides the level of protection for which it is designed. Products which rely on perimeter pressure for installation, such as a combination of plywood and metal wedges, can be installed on windows that are recessed but are not appropriate for windows that are flush with the outer face of the wall. Windows that have sash weights will have pockets on each side of the window and this construction may not provide sufficient support for the screws or bolts needed to secure storm panels.

Design details, such as shape of decorative surrounds, will need to be maintained and not modified or obscured by the mitigation option. Don't be afraid to talk directly to the manufacturer or vendor of a particular product – custom details may not be included in the catalog but special needs may be accommodated with a little creativity.

2. Is there evidence of historic shutters around the window?

Look for physical evidence of historic shutters on the building. This can be in the form of actual shutters on the premises, remnants of historic shutter hardware, existing screw holes or hinge rabbets still visible around the window or cut-outs in the window framing or trim to allow shutter movement. Historic photographs are excellent resources to document the existence of historic shutters.

If yes, operable hurricane shutters are a viable option; you want to look for an approved product that replicates the appearance of the historic shutter and utilizes hardware that is appropriate for the building.

If no, shutters are generally not an acceptable option.

3. Is there evidence of screens on the windows?

As with shutters, look for physical evidence that the windows historically had screens on them.

If yes, consider woven wire hurricane screens (not perforated metal panels). Make sure the product does not obscure the historic details of the window and that the associated hurricane screen framing replicates the appearance of the traditional wood screen frame.

If no, woven wire is generally not an acceptable option.

If there is no evidence of any historic use of storm protection, consider other options, which may include the use of temporary storm panels, a flexible wind abatement system, or impact resistant glass storm panels.

4. Is there a porch or breezeway in front of the windows?

If the answer is yes, there may be an opportunity to install a flexible wind abatement system or storm panel system on the porch. Then the windows would be protected in addition to the porch. Flexible wind abatement systems can be hidden on the inside of the porch front and rolled down when required. The design of the porch will determine if this is an option. Some strengthening of the porch may be required. (See section C below.)

B. DOORS:

1. Is there evidence of historic shutters around the doors?

Look for physical evidence of shutters on the door. This can be in the form of actual shutters on the premises, existing screw holes or hinge rabbets still visible around the door or cut-outs in the door framing or trim to allow shutter movement. Historic photographs are an excellent resource to document the existence of shutters on the building.

If yes, operable hurricane shutters are a viable option. You want to look for one that replicates the appearance of the historic shutter and use hardware that is appropriate for the building.

If no, shutters are generally not an acceptable option.

2. **Is there evidence of a historic screen door?**

As with shutters, look for physical evidence that the entries historically had screen doors on them.

If yes, look at storm doors with woven wire hurricane screens (but not perforated metal panels). Make sure the product does not obscure the historic details of the door and that the associated framing replicates the appearance of a traditional screen door.

If no, woven wire is generally not an acceptable option.

If there is no evidence of historic use of storm protection, consider other options, which may include the use of temporary storm panels, or a flexible wind abatement system.

3. **Are the garage doors historic?** If yes, historic garage doors should be reinforced on the interior side of the door, so that nothing can be seen from the exterior of the building. However, if the garage doesn't have another exit, this may not a viable option since there would be no way to get out of the garage after the reinforcing is installed. In that case, the temporary use of a flexible wind abatement system or other similar option should be considered.

C. PORCHES

1. **Are the porches securely attached to the building?**

The key consideration in protecting a porch is making sure that it is securely attached to the building and that its elements (roof decking, framing, posts, deck framing and foundation) are all connected creating a continuous load path to resist the forces of high wind. Having an architect, engineer or building professional help analyze the existing connections may be appropriate.

If not secure, consider using lag bolts, hurricane straps or other similar options to strengthen the existing connections. Make sure that this reinforcement is concealed if possible or otherwise installed to minimize its visibility.

D. ROOFS

1. **Is the roofing being replaced?**

Options obviously increase if the roofing is going to be replaced. For example, attachment of the roof deck to roof framing can easily be improved, and a self-adhering moisture resistant membrane can be added, providing protection from wind and moisture should a storm blow off the primary roof covering. Wind resistant shingles or other roofing products can be used if appropriate to the historic building.

If yes, look at storm resistant roofing materials (if they match the historic roofing material), hurricane straps or clips, improved sheathing attachment, and a self-adhering roofing membrane. Consider using a combination of options.

If no, look for options that will strengthen the connection between the roof decking and framing (hurricane straps, clips, sheathing adhesives, etc) which can be installed in the attic without affecting the existing roofing.

E. WALLS

1. **Are the connections between the walls, foundation and roof framing secure?**

The important consideration here is to establish a continuous load path by use of a system of metal connectors and fasteners that connect the structural frame of the building from the roof through the walls to the foundation. Look in the attic or under the building to see if there are hurricane straps or other connecting devices already installed.

If no, consider installing straps, clips or other options to strengthen the connections between the walls and other structural components. This is another area where an architect, engineer or building professional can help.

F. FOUNDATIONS

1. **Are the connections between the foundation and the walls secure?**

The connections between the foundation and the walls must be strong enough to support the building as well as keeping it from blowing away in high winds. Consider the options identified in Section E above, as well as reviewing at the general condition of the foundation and making needed repairs.

CHECKLIST: QUESTIONS TO ASK WHEN CONSIDERING WHAT MITIGATION OPTION MAY BE APPROPRIATE FOR A HISTORIC BUILDING

GENERAL	Is the building designated as an historic resource?
YES	**NO**
The selection procedures herein should be followed to ensure protection of historic building integrity. To determine if your building is designated as a significant historic resource you can contact your local historic review board, local planning department, or local historical society/ organization. To determine if your building is listed or eligible for listing in the National Register of Historic Places contact the Florida Division of Historic Resources or go to National Park Service's website.	*For older buildings, you are encouraged to follow the recommendations in this document to maintain the architectural and historic integrity of the building.*

GENERAL	Is the building 50 years or older? (Or has it been determined to possess exceptional significance?)
YES	**NO**
Buildings that are 50 years old or older may be eligible for listing in the National Register of Historic Places and under state and federal law are treated equally as those properties which are already listed.	*For older buildings, you are encouraged to follow the recommendations in this document to maintain the architectural and historic integrity of the building.*

GENERAL	Does the local government have any existing standards or requirements for review of historic properties?
YES	**NO**
Many local governments have ordinances which specify a required review process for changes to historic properties and have specific design requirements. These can affect the type of mitigation option that may be considered.	*For older buildings, you are encouraged to follow the recommendations in this document to maintain the architectural and historic integrity of the building.*

GENERAL	Is the mitigation part of a larger rehabilitation/renovation project?
YES	**NO**
The range of mitigation options will vary depending on the scope of the overall project. A larger budget may allow for the development of custom solutions, as opposed to being limited to looking at existing products.	*You are encouraged to follow the recommendations in this document to maintain the architectural and historic integrity of the building.*

GENERAL	Where is the funding coming from and are there associated design standards that must be met?
YES	**NO**
Use of state or federal funds, including grant monies and some permitting processes, require a formal review of the proposed changes by the Florida Department of State, Division of Historical Resources, the State Historic Preservation Officer and/or FEMA. This is in addition to any local approvals that may be needed. These reviews need to be completed prior to the initiation of construction.	*You are encouraged to follow the recommendations in this document to maintain the architectural and historic integrity of the building.*

CHECKLIST: QUESTIONS TO ASK WHEN CONSIDERING WHAT MITIGATION OPTION MAY BE APPROPRIATE FOR A HISTORIC BUILDING

GENERAL	Are there resources in your community where you can get professional help with the project?
YES	**NO**
Check with local historic preservation organizations and local planning staff. Often there are local architects with an interest in historic preservation and extensive local knowledge who may be hired to design your hazard mitigation improvements. You need someone who has demonstrated architectural experience with historic buildings so make sure that references are provided.	*Contact Division of Historical Resources for technical assistance 1-800-847-7278.*

GENERAL	Is the building feature historic, or does it have historic components?
YES	**NO**
The mitigation option chosen should preserve the historic integrity of the feature. Mitigation options vary depending on characteristics/design details of the building feature targeted for protection.	*The mitigation option should preserve surviving character defining features (for example original wood window trim) and should be compatible with the historic character of the property.*

GENERAL	Will your manpower be an issue in "activating" the damage protection measure when they are needed?
YES	**NO**
It is very important to choose products that match your capability to install and use. Something that requires a lot of manpower to close or temporarily install is not a good option if that manpower does not exist. Be realistic in your projections of the people and resources you will actually have as a storm approaches, and use that as one of the criteria for evaluating different options.	*If public works staff or a contractor will be responsible for installing protective measures before a storm or predicted disaster event, ensure that all on-site resources are readily available consistent with the emergency response plan for the site and that contract arrangements are in place in advance.*

WINDOWS	Is the window or its frame historic?
YES	**NO**
Proper installation of the window protection system is key to ensuring that a product functions properly and provides the level of protection for which it is designed. It is very important to be aware of construction and design details of the window to be protected as these will influence the choices available. Design details, such as moldings and other decorative features, will need to be maintained and not obscured by the mitigation option.	*You are encouraged to follow the recommendations in this document to maintain the architectural and historic integrity of the building. If new windows are to be installed, they should be compatible with the historic character of the property.*

WINDOWS	Is there evidence of historic shutters *around the windows*?
YES	**NO**
Permanent operable hurricane shutters are a viable option; you want to look for an approved product that replicates the historic shutter and utilizes hardware that is appropriate for the building.	*Permanent operable shutters are generally not an acceptable option. Other options can include the use of temporary storm panels, or a flexible wind abatement system, fabric panels, or permanent impact resistant storm windows.*

CHECKLIST: QUESTIONS TO ASK WHEN CONSIDERING WHAT MITIGATION OPTION MAY BE APPROPRIATE FOR A HISTORIC BUILDING

WINDOWS	Is there evidence of screens on the windows?
YES	**NO**
Consider woven wire hurricane screens (not perforated metal panels) but make sure that the product does not obscure the historic details of the window and that the associated framing replicates the appearance of a traditional wood screen frame.	*Woven wire hurricane screening is generally not an acceptable option. Other options can include the use of temporary storm panels, a flexible wind abatement system, or the use of permanent impact resistant storm windows.*
WINDOWS	**Is there a porch or breezeway in front of the windows?**
YES	**NO**
Consider installing hurricane protection at the perimeter of the porch. Consider storm panels or wind abatement systems that can protect the porch and the windows under it. Some strengthening of the porch may be required.	*Direct protection of windows will be required. See above.*
DOORS	**Is there evidence of historic shutters *around the doors*?**
YES	**NO**
Permanent hurricane shutters are a viable option; you want to look for a product that replicates the historic shutter and use hardware that is appropriate for the building.	*Shutters are generally not an acceptable option. Other options may include the use of temporary storm panels, or a flexible wind abatement system.*
DOORS	**Is there evidence of a historic screen door?**
YES	**NO**
Consider woven wire storm doors (but not perforated metal panels), but make sure the product does not obscure the historic details of the door and its surround, and that the associated framing replicates the appearance of a traditional screen door.	*Woven wire is generally not an acceptable option. Other options may include the use of temporary storm panels, a flexible wind abatement system or an impact resistant glass storm door.*
DOORS	**Are the garage doors historic?**
YES	**NO**
Historic garage doors should be reinforced on the interior side of the door, so that nothing can be seen from the exterior of the building. However, if the garage doesn't have another exit, this may not a viable option since there would be no way to get out of the garage after the reinforcing is installed. In that case, the temporary use of a flexible wind abatement system or other similar option should be considered.	*If not compliant with current codes, non-historic garage doors should also be reinforced on the interior side of the door. If replacing the non-historic garage doors, be sure that the new code-compliant doors are compatible with the historic character of the building.*

CHECKLIST: QUESTIONS TO ASK WHEN CONSIDERING WHAT MITIGATION OPTION MAY BE APPROPRIATE FOR A HISTORIC BUILDING

PORCHES	Are the porches securely attached to the building?
YES	**NO**
Make sure that they are properly maintained. See window and door protection at porches (previous pages).	*Consider using lag bolts, hurricane straps or other similar options to strengthen the existing connections. Make sure that this reinforcement is concealed if possible, or installed so as to minimize visual impacts. Professional assistance is recommended in planning and executing these improvements (architect, engineer, building professional).*
ROOF	**Is the roofing being replaced?**
YES	**NO**
Look at storm resistant roofing materials (if they match the historic roofing material), hurricane straps or clips, improved sheathing attachment, and a self adhesive roofing membrane. Consider using a combination of options.	*Look for options that will strengthen the connection between the roof decking and framing (hurricane straps, clips, sheathing adhesives, etc) which can be installed in the attic without affecting the existing roofing.*
WALLS	**Are the connections between the walls and structural elements above and below secure?**
YES	**NO**
No hazard mitigation improvements needed.	*Consider installing straps, clips or other options to strengthen the connection between the wall and the rest of the building. This is another area where professional assistance is recommended in planning and executing these improvements (architect, engineer, building professional).*
FOUNDATIONS	**Are the connections between the foundation and the building secure?**
YES	**NO**
No hazard mitigation improvements needed. Make sure that foundation features such as brick piers are maintained. Ensure that storm water does not collect against or around building foundations. Make drainage improvements as needed.	*Consider installing straps, clips or other options to strengthen the connection between the foundation and wall. This is another area where professional assistance is recommended in planning and executing these improvements (architect, engineer, building professional).*

Section 3:

CATEGORIES OF MITIGATION OPTIONS: ROOFS

Photo Courtesy of (A) Bender & Associates Architects; (B) Manausa Lewis & Dodson Architects; (C) St. Augustine Lighthouse & Museum; (D) Main Street Ft. Pierce; (E & F) Florida Trust for Historic Preservation, Inc.

HISTORICAL SIGNIFICANCE

Although the function of a roof is to protect a house from the elements, it also contributes to the overall character of the building. The character of a historic roof should be preserved, including its form and materials whenever feasible. The unique appearance of the roof is a major feature for most historic structures and often contributes to architectural style through decorative patterning and form. The roof pitch, its materials, size and orientation are all distinct features that contribute to the building's aesthetics. Particular to Florida, clay tile roofs are integral to the Mediterranean Revival style, just as cypress or cedar shingles are indicative to vernacular homes. Forms such as the turrets of the Queen Anne style, and the low slopes of the Bungalow designs are examples of the use of roofing as a major design feature.

Photos courtesy of Florida Trust for Historic Preservation, Inc.

Hays-Hood Turret with water barrier

TREATMENT OF HISTORIC ROOFS

When repairing or replacing a roof, original details affecting its visual character should be retained. One should avoid removing historic materials that are in good condition. It is important for all types of roofs to have the proper bracing and anchorage to perimeter walls and porch structure. Such retrofits will provide an economical preventative measure that will retain the historic roof fabric and form integral to the building.

PROTECTION

The roof is a building's first line of defense from a storm. A weather-tight roof is also basic to the preservation of a structure, regardless of its age, size, or design. However, all components of the roofing system are vulnerable to leaking and damage. Properly maintaining and reinforcing this highly vulnerable building element will prevent the accelerated deterioration of historic building materials, such as masonry, wood, plaster, and paint. A damaged roof can cause general disintegration of the basic structure. The very high and sustained winds hurricanes generate place the exteriors of buildings under a tremendous pushing force and possible uplift. This force can easily destroy the integrity of roof systems, especially those that are not reinforced, as is often the case in historic structures. Roofs that are not properly reinforced are likely to fail and cause major damage. Existing historic roofs can be retrofitted by strengthening and improving weather tightness while maintaining their unique features.

MITIGATION TREATMENTS

WHEN WORKING WITH *HISTORIC* MATERIALS, THE FOLLOWING IS RECOMMENDED:

When repairing or altering a historic roof, avoid removing historic roofing materials that are in good condition. Where replacement is necessary, use materials that are similar to the original in both style as well as physical qualities. Use a color that is similar to that seen historically. Specialty materials such as tile or slate should be replaced with matching material whenever feasible. A wide variety of such roofing materials meet the Miami-Dade County product approval (**www.miamidade.gov/buildingcode/pc-search_app.asp**) required by current codes.

Used with permission, St. Augustine Lighthouse & Museum

Historic photo verifies historic use of wood shingles on the roof of a 1942 WWII Coast Guard Barrack, Florida Air Museum

In repairing or altering a historic roof it is important to preserve its character. For instance, the pitch of the historic roof, the perceived line of the roof from the street, or the orientation of the roof to the street should not be altered. The historic depth of overhang of the eaves, which is often based on the style of the building, should also be preserved. For example, altering eave construction, by enclosing, concealing exposed rafter tails, or reducing an overhang should be avoided.

Installation of a secondary water barrier is encouraged except where such a treatment would be visible from the exterior or at finished/occupied spaces at the interior (for example, at the eaves or where the roof decking serves as the ceiling finish). Avoid porous insulation materials that may absorb and retain moisture. A peel and stick roof membrane is ideal as an additional barrier against water infiltration. Improving the weather tightness of historic roof features such as eaves, chimneys and dormers is encouraged, provided that the treatments do not alter their appearances. A chimney's stepped flashing should be replicated when replaced, as should the mortar and joint profile when repointing. Also protect distinct chimney caps.

WHEN WORKING WITH *HISTORIC* MATERIALS, THE FOLLOWING IS NOT RECOMMENDED:

Avoid removing historic roofing material that is in good condition.

Treatments that change the texture of a historic roof should be avoided. For instance, asphalt shingles are an incompatible substitute for original clay tiles. Also, unless the previous existence of a metal roof on the building can be demonstrated, either through investigation of physical evidence through analysis of historic documentation such as photographs, the use of metal panel roofs

would be inappropriate.

Foam roofing systems are typically inappropriate for historic roofs. They are subject to UV degradation. A roof leak in the foam system may retain and increase the level of water in the decking and wood framing, thus causing rot and damage to historic building fabric.

For hazard mitigation, roof straps or harnesses should have very limited use on historic buildings and shouldn't be used in place of a permanent passive solution such as hurricane clips. They may bend or break historic roofing materials, are not suited to the often unique forms of historic roofs and may be severed by metal roofing. However, they may be a temporary option for a building that is not yet permanently anchored to its foundation.

WHEN WORKING WITH *NON-HISTORIC* MATERIALS, THE FOLLOWING IS RECOMMENDED:

Replacement materials should match a historic material documented to have been used on the building during its period of significance. To verify use of these historic materials, look to old photos or physical evidence. If no such documentation can be found, new roofing should compliment the historic character of the building (typical to the building's age and style.)

Strengthening roofs is encouraged. The application of construction adhesives at joints between roof decking and rafters is an improvement that can be undertaken at any time from the attic. During the reroofing process, the use of ring shank nails or screws to improve attachment of decking to roof framing is recommended. Verify that the dead load capacity of rafter/joists/trusses is in accordance with the selected roofing product. Fasten roofing with nails, screws or fasteners according to manufacturer's specifications for high wind conditions.

Installation of a secondary water barrier is encouraged except where such a treatment would be visible from the exterior or at finished/occupied spaces at the interior (for example, at the eaves or where the roof decking serves as the ceiling finish). Avoid porous insulation materials that may absorb and retain moisture. A peel and stick roof membrane is ideal as an additional barrier against water infiltration.

WHEN WORKING WITH *NON-HISTORIC* MATERIALS, THE FOLLOWING IS NOT RECOMMENDED:

Unless the previous existence of a metal roof on the building can be demonstrated, either through investigation of physical evidence through analysis of historic documentation such as photographs, the use of metal panel roofs would be inappropriate.

Photo courtesy of Laura Lee Corbett Consulting

Metal roofs are an incompatoble replacement substitute for original shingle roofs.

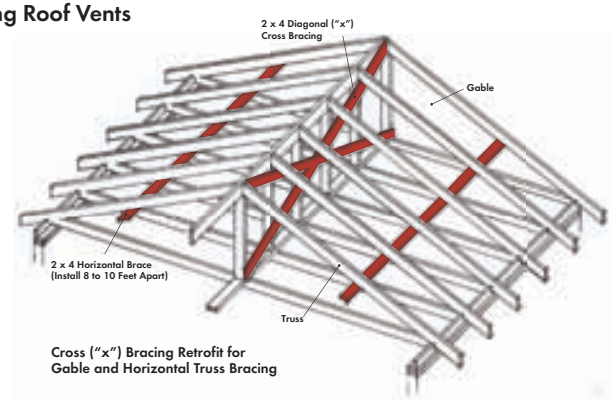
Avoid using conjectural materials or features on a roof. For example, applying a Spanish tile roof to a roof historically covered with asphalt shingles would overpower and detract from the architectural integrity of the building.

Foam roofing systems are typically inappropriate for historic roofs. They are subject to UV degradation. A roof leak in the foam system may retain and increase the level of water in the decking and wood framing, thus causing rot and damage to historic building fabric.

For hazard mitigation, roof straps or harnesses should have very limited use on historic buildings and shouldn't be used in place of a permanent passive solution such as hurricane clips. They may bend or break historic roofing materials, are not suited to the often unique forms of historic roofs and may be severed by metal roofing. However, they may be a temporary option for a building that is not yet permanently anchored to its foundation.

Don't forget...

Gable End Bracing & Protecting Roof Vents



Cross ("x") Bracing Retrofit for Gable and Horizontal Truss Bracing

Strengthening a gable end wall is usually relatively easy. Many roof systems are known as either a "gabled end" style roof or a "hip" style roof. A gabled end roof looks like an "A" on the ends and offers a large area subject to high wind forces. Buildings with gabled ends are more likely to suffer damage during a hurricane than those with hip roofs. Hip roof systems slope in all directions and tend to deflect the force of high winds. Gable end bracing provides additional diagonal bracing of the gable wall. Most historic homes with gabled end roofs will need to be retrofitted in this manner.

A complete retrofit plan should provide a means to cover gable end vents during a storm. These vents are often overlooked and need protection from wind-driven rain and debris impact. Retrofitting gable end vents with removable storm shutters will diminish the threat of damage. Otherwise the vents could allow significant wind-driven rainwater into the house, ruining insulation, carpeting and personal possessions. A temporary retrofit of this nature will still allow for ventilation to the attic space when not in use.

Photo Courtesy of Manausa Lewis & Dodson Architects

Wesley Mansion at Eden Gardens State Park, Santa Rosa Beach

Photo Courtesy of Marc Averette

Key West Armory, Florida Keys

Photos Courtesy of (A, D, E & F) Manausa Lewis & Dodson Architects; (B & C) Historic Florida Keys Foundation

A) Rafter tie down straps in masonry from Old City Waterworks, Tallahassee; B) Hurricane clips, Key West Armory; C) Hurricane straps, Key West Armory; D) Sill beam tie down strap from Jones Family Tenant House at Tall Timbers Research, Inc., Tallahassee; E & F) New rafters and tie down straps from the Wesley Mansion at Eden Gardens State Park, Santa Rosa Beach

Hurricane Clips

To make sure the roof stays in place when severe winds blow, securely anchor roof-to-wall connections by installing hurricane straps or clips at every rafter to wall connection. These connections are critical in holding the roof on and will dramatically increase the building's overall resistance to wind. However, it is not enough to just connect the roof to the tops of the walls. The uplift loads have to be carried far enough down into the house so that the weight of the house including the floors becomes greater than the uplift forces caused by the wind. This is called developing a continuous load path. Along with roof-to-wall connections, all joints in the structure, floor-to-floor and wall-to-foundation must also be secured to create a continuous load path to the building's foundation.

Temporary Stabilization

In the event of damage, it may be necessary to carry out an immediate and temporary stabilization to prevent further deterioration until research can determine how the roof should be restored or rehabilitated, or until funding can be provided to do an appropriate permanent repair. A simple covering of exterior plywood or roll roofing might provide adequate protection, but any temporary covering should be applied with caution. One should be careful not to overload a compromised roof structure, or to damage or destroy historic evidence or fabric that might be incorporated into a new roof at a later date. In this sense, repairs with caulking or bituminous patching compounds should be recognized as potentially harmful, since they are difficult to remove, and at their best, are very temporary.

Typical Connections Used to Create A Continuous Load Path

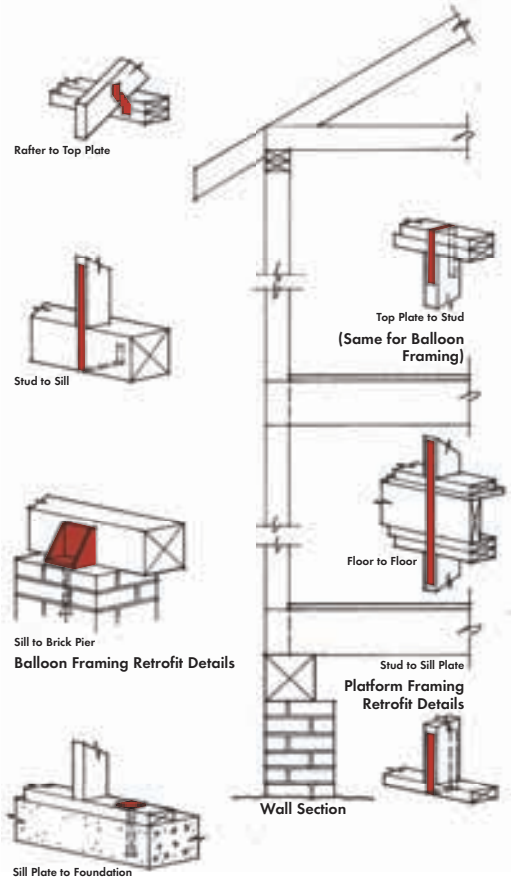


Photo Courtesy of Division of Emergency Management, Bureau of Mitigation

Chimneys are vulnerable roof features that require securing.

Roof Replacement

Photo Courtesy of Division of Emergency Management, Bureau of Mitigation

A roof tarp provides temporary stabilization.

There may be valid reasons for replacing the roof with a material other than the original. The historic roofing may no longer be available, or the cost of obtaining specially fabricated materials may be prohibitive. But the decision to use an alternative material should be weighed carefully against the concern to preserve the historic character of the building. The alternative material should match as closely as possible the scale, texture, and coloration of the historic roofing material. The overall pattern and texture of the historic roofing material also determines whether or not certain materials are appropriate. For instance, cedar and asphalt shingles have a relatively uniform texture, while standing seam metal roofs create a vertical pattern. The color of the repaired roof section should also be similar to the historic roof material. Historic roofing materials such as clay tiles, cedar shingles and slate are available with the Miami-Dade County product approval required for code compliance in areas subject to high wind.

For additional information...

FEMA:

http://www.fema.gov/plan/prevent/howto/index.shtm#5

See "Protect Your Property from High Winds"

Department of Emergency Management:

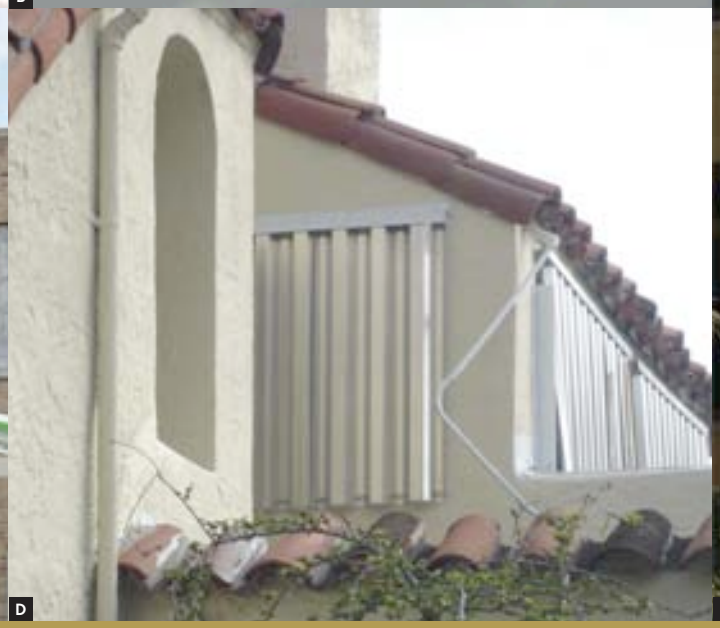
http://www.floridadisaster.org/mitigation/rcmp/hrg/content/roofs/roofs_index.asp

Park, Sharon C. ***Preservation Briefs 19: The Repair and Replacement of Historic Wooden Shingle Roofs.*** Washington, D.C.: Technical Preservation Services, National Park Service, U.S. Department of the Interior. http://www.nps.gov/history/hps/tps/briefs/presbhom.htm

Levine, Jeffrey S. ***Preservation Briefs 29: The Repair, Replacement and Maintenance of Historic Slate Roofs.*** Washington, D.C.: Technical Preservation Services, National Park Service, U.S. Department of the Interior. http://www.nps.gov/history/hps/tps/briefs/presbhom.htm

Grimmer, Anne E. and Paul K. Williams. ***Preservation Briefs 30: The Preservation and Repair of Historic Clay Tile Roofs.*** Washington, D.C.: Technical Preservation Services, National Park Service, U.S. Department of the Interior. http://www.nps.gov/history/hps/tps/briefs/presbhom.htm

Pieper, Richard. ***Preservation Tech Notes: Metals #2: Restoring Metal Roof Cornices.*** Washington, D.C.: Technical Preservation Services, National Park Service, U.S. Department of the Interior. http://www.nps.gov/history/hps/tps/tecnotes/PTN32/intro.htm



Section 3:

CATEGORIES OF MITIGATION OPTIONS: WINDOWS

Photo Courtesy of (A) Bender & Associates Architects; (B & D) 1000 Friends of Florida; (C) Stevenson architects, Inc.; (E) REG Architects

HISTORICAL SIGNIFICANCE

As with doors, windows are often among the most important and highly visible features of a building and can have a strong impact on the building's overall design. Their placement, design and materials serve to articulate and give definition to design-specific styles and periods of time. For example, in Bungalows, multiple panes are usually present in the upper window sash, and in Mediterranean Revival designs, windows are frequently arched. Unique qualities such as these and the craftsmanship and superior materials of historic windows often make them worthy of preservation. In pre–World War II designs, windows were most frequently either wooden or metal single- or double-hung or casement types. After the war, jalousie, awning and hopper window types became more common. Retaining original windows is ideal. This is clearly the case for ornamental windows such as the geometric patterned windows of the Prairie style and the pointed arch windows of the Gothic style, but is also important to the historic integrity of modest vernacular residences. It can be equally true for commercial and industrial buildings where the windows may be the most dominant visual element of an otherwise nondescript building.

Windows should be considered significant to a building if they: 1) are original, 2) reflect the original design intent for the building, 3) reflect period or regional styles or building practices, 4) reflect changes to the building resulting from significant alterations or events, or 5) are examples of exceptional craftsmanship or design.

TREATMENT OF HISTORIC WINDOWS

Historic windows that are in good condition should be retained. Maintain historic windows with periodic cleaning, rust removal, surface protection and repainting, and reapplication of glazing putty. Recaulk and replace deteriorated weather stripping as needed to make windows watertight and improve thermal efficiency.

PROTECTION

Windows and doors are the weakest features of a building subject to hurricane force winds and associated air borne debris. If these features fail, the wind can rip off the roof and cause walls to collapse. Even if the structure remains intact, the wind and water can scour the interior and damage the contents. Unprotected windows can be penetrated easily by wind-borne debris. Covering all French doors, sliding glass doors, windows and skylights is the most effective way to secure the building envelope and ensure building integrity during high wind events. All windows need to be protected during a hurricane with the exception of those modern windows that meet current code requirements.

MITIGATION TREATMENTS

WHEN WORKING WITH *HISTORIC* FEATURES, THE FOLLOWING IS RECOMMENDED:

Historic windows that are in good condition should be retained, not replaced. Providing storm protection for these windows should preserve all associated features and trim including the sash, muntins, glazing, sills, heads, hood molds, paneled or decorated jambs and moldings, and shutters and blinds. Protect historic windows with the following options:

Shutters

Shutters are often important features associated with windows. During the Victorian era, shutters protected the home and windows from weather. By the late nineteenth century, shutters were as much for decoration as for protection. In Florida, louvered shutters were often incorporated into buildings for a variety of practicalities.

If shutters were installed on the building historically, but have been lost, replacement shutters are a highly desirable alternative for storm protection. They can be made of wood, vinyl, aluminum or composite fiberglass. Styles include louvered, raised panel, solid board and Bahama, though the latter has limited application as it was rarely used historically in Florida. Upgraded historic shutters or replacement shutters can provide effective protection to historic windows. Replacement shutters should match the size and general design of the historic shutters used on the building. Please see the back of this manual for more information on these products.

Louvered, Raised Panel & Solid Board Shutters *(image on page 23: A, B, E)*

More traditional in style and compatible with much of Florida's historic architecture, these shutters are hinge mounted at the sides of window openings. Prior to a storm, the shutters are closed and locked at the center, completely covering the opening. Shutter dogs, clips or hooks are installed to hold the shutters against the wall when not in use. Several manufacturers market wood shutters that replicate the appearance of a range of historic shutter types and are fitted with storm panels (not all meet Miami-Dade County certification requirements). Metal shutters with simulated louvers are also available but less desirable for use on historic buildings.

Bahama Shutters *(image on page 24: C)*

Though rare in Florida, some Bungalow and coastal vernacular buildings were historically fitted with wood Bahama shutters. Modern Bahama shutters are fixed louver shutters with a top hinge (constructed of aluminum or wood). The shutters are lowered into a closed position by disconnecting telescopic arms. While these shutters are an affordable and a practical alternative to mechanical shutters, careful consideration should be given to the original style and design of a building.

Manufactured Storm Panels

If shutters were not installed on the building historically, a fully demountable storm panel system is recommended. Storm panels are one of the most cost effective solutions for protection. However, they may not be the best for use on all historic resources as their installation may damage original building fabric. Storm panels can be constructed of aluminum, steel (image G below), or clear polycarbonate (Lexan®) panels *(images D and H below)* that are designed for temporary installation. Clear polycarbonate sheets are heavier and more costly than plywood, but are much more resistant to debris impacts and about as easy to cut and drill. They also have the added advantage of allowing sunlight into a "boarded up" building.

Upon initial installation of a storm panel unit, channels or tracks *(images F, I, J, K; below; and image D, page 24)* are bolted into threaded inserts installed in the wall at the building's exterior. Often the head and sill channels for these panels are installed and left in place for the duration of hurricane season, facilitating easy installation of overlapping storm panels upon the approach of a storm. To reduce the visual impact of such installations, it is recommended that the head and sill channels be painted the same color as the finish material to which they are mounted. Direct wall mounting of storm panels is also available. Such panels must be stored when not in use. Storm panels are considered a compatible treatment for the protection of historic resources. However, they require significantly more preparation effort than flexible wind abatement systems or fabric panels and consideration should be given to the storage requirements, the weight of the panels and the effort required to install them, especially for upper story windows.

MITIGATION TREATMENTS: WHEN WORKING WITH *HISTORIC* FEATURES, THE FOLLOWING IS RECOMMENDED

Photos Courtesy of 1,000 Friends of Florida (A, B, C, D, F, G, I); Bender & Associates Architects (E, H)

A) Closed Louvered Shutters; B) Open Louvered Shutters; C) Aluminum Awning Shutter; D) Removable Clear Polycarbonate Storm Panel; E) Solid Board Shutter; F) Concealed track above; G) Metal Storm Panel; H) Permanent 3/8" lexan® storm panels from the Southernmost Prayer and Faith Center Church, Key West; I) Track above & below; J) Painted Storm Track K) Direct mount storm panel attachment points can be hidden with colored plugs when not in use.

MITIGATION TREATMENTS: WHEN WORKING WITH *HISTORIC* MATERIALS, THE FOLLOWING IS NOT RECOMMENDED:

Photos Courtesy of Florida Photographic Collection (A); Bender & Associates Architects (B, C); 1,000 Friends of Florida (D, E)

A) Monroe County Court House prior to installation of perforated metal panels; B) The permanent installation of perforated metal panels obscures the historic windows of the Monroe County Court House; C) Bahama Shutters from the Harvey Government Center, Key West; D) Unpainted Storm Panel Track; E) Perforated Metal Panel from the Vizcaya Museum & Gardens in Miami

Perforated Metal Panels *(image on pages 24: B & E)*

These panels adversely affect the appearance of the building by largely obscuring the historic window, and also diminishing light to the interior, however they do provide effective protection. It is recommended that perforated metal panels are used as a temporary removable mitigation measure and that they are installed in a way as to minimize damage to the existing historic building fabric.

Plywood Panels

One of the easiest and least costly ways to provide protection, plywood panels should be prepared in advance so they can be easily installed during a hurricane threat. Measure each window and add eight inches to both the height and the width to provide a four-inch overlap on each side of the window or door. Sheets of plywood are generally 4 x 8 feet. Consider the size and number of openings that need to covered in order to determine how many sheets to buy. Installation requires bolts, wood or masonry anchors, large washers, and 5/8-inch exterior grade plywood. Where a brick reveal exists – in solid or veneer brick construction – installation with specially designed metal clips will help prevent damage to the historic building fabric.

Storm Screens

In some cases, storm screens have been permanently installed over the historic windows on upper stories, where access for standard metal storm panel installation is a problem. The porous screens, which are secured with metal pins, screws or grommets, protect openings while allowing minimal interference with the visual qualities of the fenestration. To further minimize the adverse effects of these installations, the panel frame should be designed to resemble a traditional window screen frame. The screens can be installed upon the threat of a storm, (though they are generally heavy and cumbersome to install). Newer products are more lightweight. Use of storm screens is typically promoted for inaccessible openings such as small or obscure windows or those windows found at the upper levels of multi-story buildings.

Storm Windows

Exterior storm windows are cost-effective, reversible, and allow the retention and improvement of original windows. However, they should be used in select cases due to their visual impact. Also, provisions must be made to prevent deterioration of the historic window fabric as a result of their installation. Storm window frames may be made of wood, aluminum or vinyl. The use of mill finish or clear anodized aluminum storms should be avoided. The visual impact of storm windows may be minimized by selecting frame colors which match existing trim color or by utilizing a frame which visually resembles historic window screens which may have existed on the building. Although interior storm windows appear to offer an attractive option for achieving double glazing with minimal

visual impact, this type of installation protects the building envelope but leaves the existing windows unprotected. Moisture which becomes trapped between the historic window and storm sash can condense, potentially leading to deterioration. To avoid this problem, create a seal on the interior storm window while allowing some ventilation around the prime (exterior) window. If exterior storms are used, vent the airspace to the interior.

Hurricane Screening/Fabric (Flexible Wind Abatement Systems)

(image A)

There are several new plastic mesh curtain products or flexible wind abatement systems that may have application in protecting large window compositions, groups of windows or the entire sides of buildings. Typically these products are attached to a series of hooks or loops in a metal track anchored above the opening to be protected. The bottom of the curtain is commonly anchored to the ground a distance away from the base of the wall and stretched tight. These flexible wind abatement systems are designed to stretch a pre-calculated amount to allow for the deceleration and deflection of impacting debris. One extreme example is a curtain that extends over an entire structure, anchored to the ground on opposite sides, providing protection against flying debris while anchoring down the entire building. These systems appear acceptable for use on historic buildings with simple roof forms and without features such as dormers and chimneys.

WHEN WORKING WITH *HISTORIC* MATERIALS, THE FOLLOWING IS NOT RECOMMENDED:

Perforated Metal Screens or Panels *(images on page 24: B & E)*

Used at the exterior of historic windows, perforated metal screens or panels will adversely affect appearance and historic character. However, the visual impact of such installation can be minimized by utilizing a frame which resembles those of the historic window screens found on the vast majority of historic buildings before the age of air conditioning.

Accordion Shutters *(images D and E)*

Typically constructed of metal which folds and unfolds gliding along a set of permanent tracks. Accordion shutters fold to the sides when not in use and remain permanently attached to the building. Pulling the shutters across the opening and locking them into position takes only minutes of preparation. While these shutters are convenient, they are very intrusive for historic resources as the shutters are permanently installed on the outer face of the wall, often requiring removal of historic trim. Because of these factors, this type of protection is not encouraged for historic buildings.

Roll-up Shutters *(images B and C)*

Providing full vertical protection for any opening, these shutters consist of PVC or aluminum slats and are operated manually or electronically/motor driven. While an easy form of protection, these systems are expensive. Tracks are installed at each side of the opening to guide the shutters and secure the slats and housing mechanism. However, the housing mechanism (shutter box), when installed on the building's exterior, is disruptive to the building façade. Roll-up shutters are generally considered inappropriate for use on historic buildings.

Impact Resistant Glass Reglazing & Window Film

Reglazing a historic window with impact resistant glass is generally discouraged due to its thickness and weight. (9/16" impact glass vs. 3/16" single strength historic glass). Most historic windows are not able to accommodate impact resistant glass. This is because the historic

MITIGATION TREATMENTS: WHEN WORKING WITH *HISTORIC* MATERIALS, THE FOLLOWING IS RECOMMENDED:

Photo Courtesy of Division of Emergency Management, Bureau of Mitigation

A) Flexible Wind Abatement System
B & C) Roll-Up Shutters
D & E) Accordian Shutters

MITIGATION TREATMENTS: WHEN WORKING WITH *HISTORIC* MATERIALS, THE FOLLOWING IS NOT RECOMMENDED:

Photos Courtesy of 1,000 Friends of Florida (B- E)

glazing stop and rabbet are not deep enough to keep the glass in the openings. A retrofit of this nature cannot be accomplished without permanent modification of the historic window. Generally, such modification is inconsistent with recommended preservation practices.

Window film retrofits are generally discouraged as well. Much like a broken windshield, these film systems do not prevent the glass from breaking. Rather, they hold the glass together but will not keep it in place unless overlapped with film covering the frame and a portion of the glass to form a wind and watertight seal. The effectiveness of such retrofits would be limited by the strength of the historic window frame.

WHEN WORKING WITH *NON-HISTORIC* MATERIALS, THE FOLLOWING IS RECOMMENDED:

All recommended treatments above in addition to the following:

Window Replacement

Replace non-historic windows with Miami-Dade County certified windows. New windows should match the historic window as closely as possible in size, type, style, proportion, material, element profiles, frame, arrangement and number of divided lights. When replacing failed windows, preserve the original casing and frame if feasible, and install replacement sash matching the original design as closely as possible. If an exact match is not possible, consider all of a window's characteristics and its importance in the facade when selecting a replacement. The attachment of the window to the surrounding framing, whether historic or a replacement, is very important to the effectiveness of a protective window system. No matter how strong the window is, if it is not properly installed, the system can fail. Replacement windows on primary facades should match the material and design of the historic windows or as closely as possible. Vinyl and aluminum replacements may be considered on secondary facades, provided that the original casings are preserved, the original glazing pattern is maintained, and the profile and finish of the replacement window are similar to the historic window. Replacement windows with internal muntin grids (grids between 2 sheets of glass) are never acceptable for use in a historic building.

Photo Courtesy of Laura Lee Corbett Consulting

Replacement windows on side of residence.

Impact Resistant Glass Replacement Windows

Available in a variety of sizes and light configurations, replacement windows can mimic the historic single or double hung sash, casement, fixed, or awning windows found in many historic buildings. Replacement windows are typically made of aluminum to resist rot and pest infestation, but are also available in wood and steel. This is a desirable alternative to shutters and as a replacement for non-historic windows. Replacement windows on primary facades should match the material and design of the historic windows or as closely as possible. Vinyl and aluminum replacements may be considered on secondary facades, provided that the original casings are preserved, the original glazing pattern is maintained, and the profile and finish of the replacement window are similar to the historic window.

WHEN WORKING WITH *NON-HISTORIC* MATERIALS, THE FOLLOWING IS NOT RECOMMENDED:

Replacement windows on primary facades should match the material and design of the historic windows or as closely as possible. Vinyl and aluminum replacements may be considered on secondary facades, provided that the original casings are preserved, the original glazing pattern is maintained, and the profile and finish of the replacement window are similar to the historic window.

Don't forget...

For additional information:

Myers, John H. ***Preservation Briefs 9: The Repair of Historic Wood Windows.*** Washington, D.C.: 1981, Technical Preservation Services, National Park Service, U.S. Department of the Interior.

Department of Emergency Management: http://www.nps.gov/history/hps/tps/briefs/presb-hom.htm

http://www.floridadisaster.org/mitigation/rcmp/hrg/content/openings/openings_index.asp

PALM BEACH COUNTY COURT HOUSE

PROBLEM:

Over the years, the 1916 Historic County Courthouse in Downtown West Palm Beach had undergone substantial alterations that changed its appearance. This included a wraparound building which encapsulated the original building inside of a new structure. In 2002, the Palm Beach County Board of County Commissioners committed to restoration of the building to its 1916 form. Once the wraparound structure was removed, it was noted that the entire east elevation of the building would have to be recreated to match the original 1916 east elevation.

Photos Courtesy of REG Architects, Inc.

A) Restored West Elevation; B) East Elevation May 06; C) Existing Window Condition

CHALLENGES

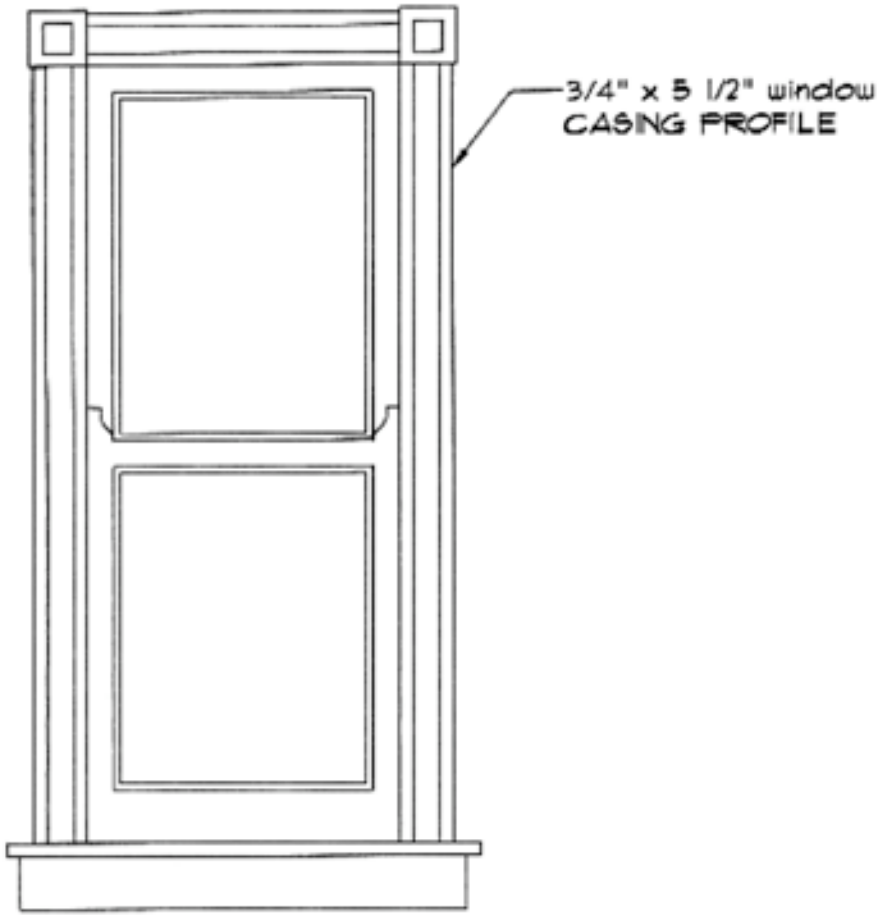
This restoration presented two challenges: 1) how to provide hurricane protection for the new windows, which would be easy for the end user to install, and 2) how to reinforce existing windows which are located in terra-cotta block and clay brick walls.

SOLUTION:

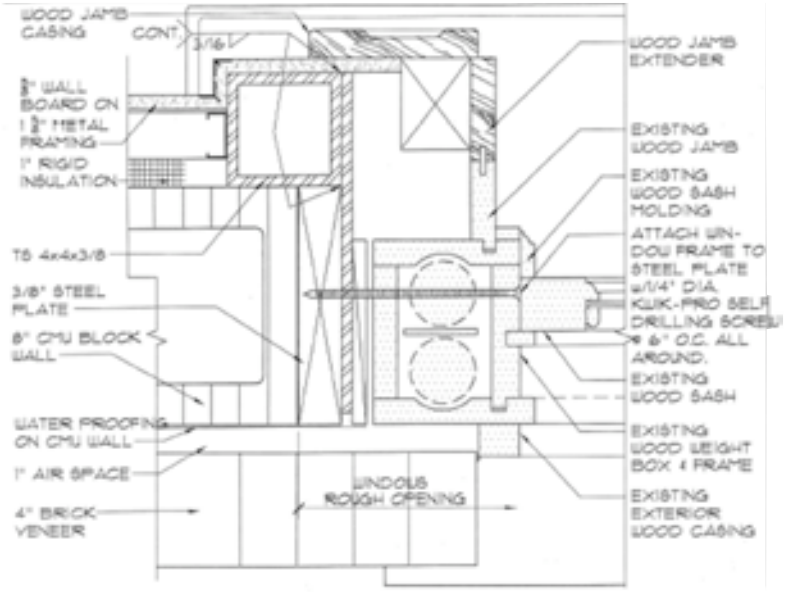
In order to resolve the first challenge, a local company was found that built exact replicas of the existing windows with wood framing and impact glass. The assembly was tested and received Notice of Acceptance (NOA) approval. These windows were installed in the new east elevation CMU wall so there was no issue of attachment for this system.

The second challenge was addressed by providing structural support for the windows in the existing walls prior to re-installing the existing windows on the north, west and south elevations. The existing structure was primarily terra cotta block with brick exterior. In order to strengthen the surrounding structure, a detail was created to install inboard steel columns to be placed on both sides of the window openings. A steel header and steel sill were also provided in some cases. In other cases concrete headers and sills with concrete columns were installed on either side of the window opening. The reinforcing structure was attached to the concrete floors and ceilings.

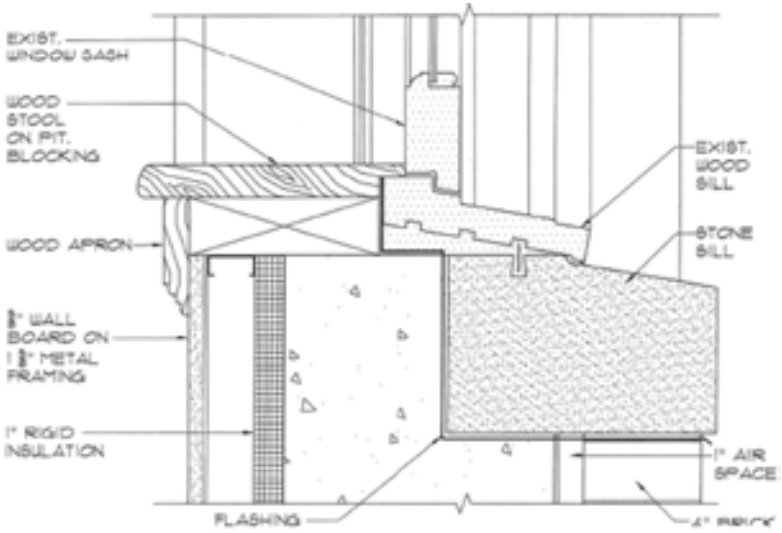
D) Final Reconstruction East Elevation



A



B

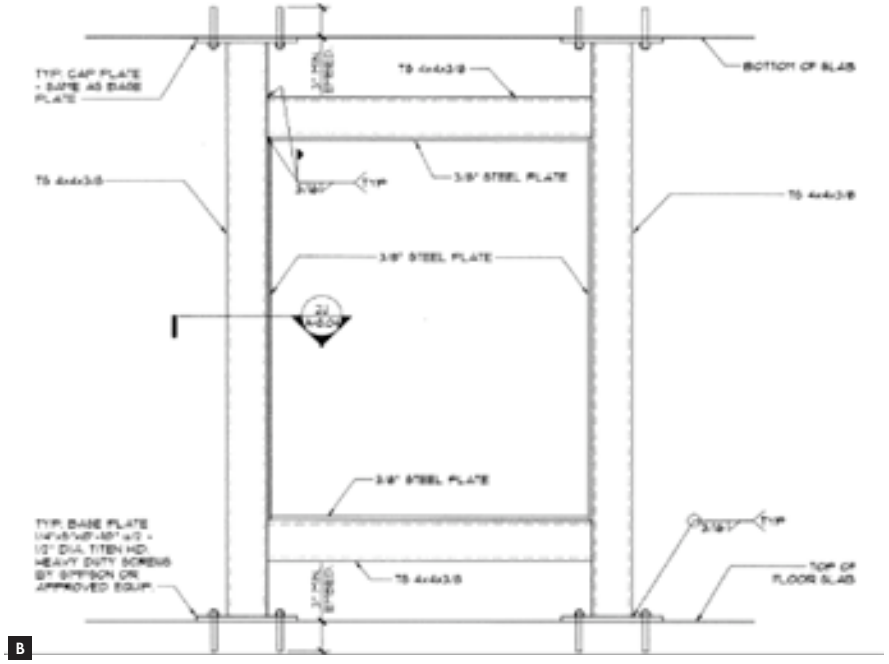


C

Illustrations Courtesy of REG Architects, Inc. (A-C)

A) Elevation of Window on Interior Side of Opening; B) Reinforced Window Jam Detail; C) Window Sill Detail

PALM BEACH COUNTY COURT HOUSE



A) Restored Wood Windows (North Elevation); B) Window Opening Reinforcing Detail; C) Restored Wood Windows; D) Column Detail

Photos & Illustration Courtesy of REG Architects, Inc.

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SEBRING FIRE HOUSE

PROBLEM:

The historic Sebring Fire Station contained original steel windows that dated from its construction in 1927. While the window frames were steel, the glass was 1/8" regular float glass and provided no protection from the impact of wind borne debris. Additionally, some of the exterior doors did not have rated glass in them. During the storm events of 2004 and 2005, some of the glass panes were broken out. As the building is a critical facility for the City of Sebring during emergencies, it was imperative that the building envelope be secured to meet current Florida Building Code requirements and to allow the Fire Department to carry out emergency operations from the building during storm events.

TYPES OF PROTECTION:

The project proposed replacement of the existing windows with new code compliant and impact approved steel windows that maintain the historic integrity of the building. Some the exterior doors were also replaced as necessary with rated doors.

SCOPE OF WORK:

The existing steel windows were dismantled and removed. The new steel impact approved windows and doors were installed to meet requirements of the Florida Building Code. The proposed design has been reviewed and approved by the Florida Division of Historical Resources.

CHALLENGES:

Only one manufacturer, Hope's Windows, (Jamestown NY) had an approved Notice of Acceptance (NOA) for steel windows.

No steel window manufacturers had a Notice of Acceptance (NOA) available for single hung steel sash.

SOLUTION:

The second floor windows were designed with a slight offset between the upper projecting sash and the lower fixed sash to approximate the appearance of the original single hung sash. This satisfied the SHPO's concern that the windows match the original configuration as closely as possible, given the design constraints and limited availability of appropriate products to achieve the project goals.

The selected product, Jamestown 175, impact glass, windows met the project criteria. There were two installation conditions, the first floor windows were installed with masonry clips. The second floor windows were installed on pressure treated 2 x framing installed within the original brick masonry "pocket".

Photos Courtesy of Stevenson Architects, Inc.

A) North-Window; B) West Wall After New Window; C) Window Installation on Facade

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MITIGATION TREATMENTS

	RECOMMENDED	RECOMMENDED AS TEMPORARY SOLUTION	NOT RECOMMENDED
Louvered Shutters	X		
Raised Panel Shutters	X		
Solid Board Shutters	X		
Bahama Shutters	X		
Perforated Metal Panels		X	
Plywood Panels		X	
Storm Screens	X		
Storm Windows	X		
Hurricane Screening/Fabric (Flexible Wind Abatement Systems)		X	
Perforated Metal Screens or Panels		X	
Accordion Shutters			X
Roll-up Shutters			X
Impact Resistant Glass Reglazing & Window Film			X
Impact Resistant Glass Replacement Windows *			X

* Acceptable if original windows are lost and new windows are consistent with the material and design of the historic windows.

Section 3:

CATEGORIES OF MITIGATION OPTIONS: DOORS

Photos Courtesy of Laura Lee Corbett Consulting

HISTORICAL SIGNIFICANCE

Consider a door's place both as a component of the facade and as a contributor to the interior space. Original or older doors can add to the special character of a historic residence or commercial building. As an example, board-and-batten doors often contribute to the character of Tudor, Spanish Colonial and Spanish Eclectic styles found in Florida. Rectangular transoms and side lights are usually integral features to the Greek Revival style, just as elliptical fanlights and broken pediments are associated with the Colonial Revival style. Removal of or obscuring such features would detract from the overall historic character of the building.

TREATMENT OF HISTORIC DOORS

Historic doors should be retained and protected, not replaced. This includes both entry doors and garage doors as they are integral elements to the design of a historic building. Historic doors that are sound and repairable should be properly maintained. Historic glazing and hardware should be preserved. The original frame should be retained along with original associated features such as the transom, sidelights, portico, and pediments. Assure that the frames and doors have regular painting, and that caulking and weather stripping is applied as necessary. When repairing or altering a historic door, avoid removing historic materials that are in good condition and instead replace severely deteriorated components and reverse earlier, inappropriate repairs. Original or similar finish should be maintained. To the extent possible, required alterations should be reversible.

PROTECTION

Doors and windows are the weakest places on a building during a hurricane and if these openings fail, the wind can rip off the roof and cause walls to collapse. Even if the structure remains intact, wind and water can scour the interior and wreck the contents. Unprotected standard doors can be penetrated easily by wind-borne debris in a hurricane. Covering all French doors and sliding glass doors is the most effective way to secure the building envelope and ensure building integrity during high wind events. If the door has glass inserts, measures should be taken to protect the glass (see section on window protection). There are four things to consider for exterior entry doors in reducing the likelihood of damage or water intrusion during a hurricane. They are:

- The strength of the door including its ability to resist windborne debris impacts
- The anchorage of the door to the door frame in its closed and locked position including its ability to remain closed
- The anchorage of the door frame to the wall structure
- Reducing the potential for water intrusion

MITIGATION TREATMENTS

WHEN WORKING WITH *HISTORIC* DOORS, THE FOLLOWING IS RECOMMENDED:

Flexible Wind Abatement Systems

There are several new plastic mesh curtain products (flexible wind abatement systems) that may have application in protecting large open areas like screened porches, elaborate entry compositions including doors, sidelights and transoms, or the entire sides of buildings. Typically these products are attached to a series of hooks or loops in a metal track anchored above the opening to be protected. The bottom of the curtain is commonly anchored to the ground a distance away from the base of the wall and stretched tight. This type system is designed to stretch a pre-calculated amount to allow for the deceleration and deflection of impacting missiles. One extreme example is a curtain that extends over an entire structure, anchored to the ground on opposite sides of the structure, providing protection against flying debris while anchoring down the entire building. These whole-structure systems appear acceptable for use on historic buildings with simple roof forms and without features such as dormers and chimneys.

Weather Stripping

When subjected to wind-driven rain, doors are going to leak. The key is to minimize or manage the water intrusion. Keeping water from being driven against and building up on doors is one way to try and minimize the water intrusion during a hurricane. If the historic door is sound but the weather stripping is damaged or has lost its flexibility, then consider replacing the weather stripping.

Shutters

Some doors historically had shutters associated with them. For such doors, restoring the shutters to functional condition and upgrading them can protect against the impacts of windborne debris. However, shutters won't keep the doors from bursting open from wind pressure if they are weak or poorly anchored to the walls of the house. Choose shutters with a code approved pressure and impact rating.

Storm Panels

If shutters were not installed on the building historically, a fully demountable storm panel system is recommended. Storm panels are one of the most cost-effective solutions for protection. However, they may not be the best for use on all historic resources as their installation may damage historic fabric.

Storm panels can be constructed of aluminum, steel, or clear (Lexan®) panels that are designed for temporary installation. Upon initial installation of a storm panel unit, channels or tracks are bolted into the building's exterior. Often the head and sill channels for these panels are installed and left in place during the hurricane season and removed at the end of November each year. To reduce the visual impact of such installations, it is recommended that the head and sill channels be painted the same color as the finish material to which they are mounted. These pre-mounted channels then

facilitate easy installation of storm panels upon the approach of a storm. Direct wall mounting of panels is also an available option. Typically, threaded inserts are installed at the perimeter of the opening to anchor head and sill channels (or, in the case of direct-mounting, the panels) to the wall structure. Such panels must be stored when not in use. These fully demountable storm panels are generally considered a compatible treatment for the protection of historic resources. However, they require significantly more preparation effort than a flexible wind abatement system and consideration must be given to the provisions for storage and weight of the panels.

Storm Doors

A storm door would also improve the performance of the historic door. Select one that is Miami-Dade or Florida Building Code approved for impact resistance. The storm door should be designed and installed to minimize the visual impact on the building's appearance, ideally resembling a traditional screen door with either impact glass or woven wire mesh panels. The storm door may also be painted to match the colors of the historic door and its trim, or painted the same color as the historic door frame. Avoid the use of storm doors or metal grille security doors that obscure or detract from the architectural character of the original door.

Plywood and Polycarbonate Panels

One of the easiest and least costly ways to provide protection, plywood panels must be prepared in advance so they can be easily installed during a hurricane threat. Measure each door and add eight inches to both the height and the width to provide a four-inch overlap on each side of the door. Sheets of plywood are generally 4 x 8 feet. Consider the size and number of openings that need to covered in order to determine how many sheets to buy. Installation requires bolts, wood or masonry anchors, large washers, and minimum 5/8-inch exterior grade plywood. Polycarbonate sheets provide another type of do-it-yourself panel that is much more resistant to debris impacts than plywood and is about as easy to cut and drill. Installation of such panels does result in some damage to the building fabric which will require repair after the panels are removed. Polycarbonate sheets are also heavier and more costly than plywood.

WHEN WORKING WITH *HISTORIC* DOORS, THE FOLLOWING IS NOT RECOMMENDED:

Removing historic doors that are in good condition and enclosing or altering the size of a historic door opening. Use of incompatible and obtrusive storm doors or metal grille security doors is also not recommended.

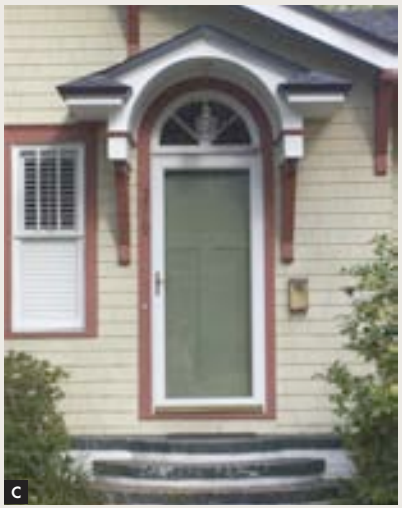
Reglazing with Impact Resistant Glass & Window Film

Reglazing a historic door with impact resistant glass is generally discouraged due to the thickness. (9/16" impact glass vs. 3/16" single strength historic glass). While it may be possible to retrofit some types of historic doors with this specialty glass, most glazed doors are not able to accommodate impact resistant glass. This is because the historic glazing stop and rabbet are not deep enough to keep the glass in the openings. A retrofit of this nature cannot be accomplished without permanent modification of the historic door. Generally, such modification is inconsistent with recommended preservation practices. Impact glass will also substantially increase the weight of the door.

MITIGATION TREATMENTS: WHEN WORKING WITH *HISTORIC* DOORS, THE FOLLOWING IS RECOMMENDED:

Courtesy of the University of West Florida Archaeology Institute

Courtesy of Bonnet House Museum & Gardens



Courtesy of Laura Lee Corbett Consulting

Courtesy of Laura Lee Corbett Consulting

A) Closed Louvered Door, Lavalle House; B) Closed Shutter Door, Historic Bonnet House; C) Storm Door; D) Storm Door

Window film retrofits are generally discouraged as well. Much like a broken windshield, these film systems do not prevent the glass from breaking. Rather, they hold the glass together but will not keep it in place unless overlapped with film covering the frame and a portion of the glass to form a wind and watertight seal. While such film installations would provide some degree of protection to a building's interior, their effectiveness would be limited by the strength of the door construction.

WHEN WORKING WITH *NON-HISTORIC* FEATURES, THE FOLLOWING IS RECOMMENDED:

Door Replacement

In the case where historic doors are deteriorated beyond repair, or have already been replaced with an inappropriate modern door, any new treatments should be compatible with the historic character of the building. When replacement is necessary, the original door location, shape and size should be maintained. Original trim should be retained and reused in the new installation. The new replacement door should match as closely as possible the architectural detailing and material of the original door. If the design of the original door is unknown, look to designs that are compatible with the building's style or architectural character.

Many rated doors are available in wood reinforced with metal. Although metal, fiberglass and vinyl clad doors are generally discouraged, they can be acceptable if the product is architecturally compatible and successfully mimics the appearance of the historic door. The replacement door that is installed should be rated for specific wind pressures of at least 38 psf positive and negative pressure (47 psf negative only if installed within 6 feet of corners). Always purchase a replacement product or system that has been tested and certified as passing one of the large missile impact standards (i.e. 9-lb 2x4 wood member striking end on at a specified impact speed).

Impact Resistant Glass

If the historic doors are missing, impact resistant glazed doors are available in a variety of sizes and light configurations that replicate historic designs. Typically made of aluminum to resist rot and pest infestation, such impact resistant doors are also available for some styles in wood reinforced with metal. These are a desirable alternative to storm panels as a replacement for missing or irreparable historic doors.

WHEN WORKING WITH *NON-HISTORIC* FEATURES, THE FOLLOWING IS NOT RECOMMENDED:

Use of replacement doors that are incompatible in appearance with the character of the historic building is inadvisable. Unless verified as matching the historic material or the product successfully mimics the historic design and materials, metal, fiberglass and vinyl doors are not appropriate to most historic structures. Installation of new doors that require the alteration of the historic door opening or loss of historic trim and associated features such as the transom and sidelights is not recommended. Also avoid the use of incompatible and obtrusive storm doors or metal grille security doors.

Don't forget...

Side Latches or Drop Bolts

Doors can get pulled out as well as get pushed in. Adding slide latches can add strength to the lock side of the door. Insure the latches are substantial and have long enough screws to hold them in place. Doors should have at least three hinges and a security lock with a dead bolt that is 3/4" to 1" long. However, installation of a stronger lock and supplemental slide latches may not offer much additional protection if the door or door jamb is damaged or inadequately anchored to the wall construction.

Sliding Glass Doors

Sliding glass doors are particularly vulnerable and protecting them is more difficult than standard doors due to the size of the opening. They can be protected by some types of manufactured shutters, storm panels and window films. Because of its weight, impact resistant glass may not be a feasible glazing upgrade. One of the least expensive options is to make a wood frame and plywood panel system. Please see the windows section of this manual for a description of these various protection options.

Double Entry Doors

Courtesy of Laura Lee Corbett

Typical double doors are vulnerable to failure from wind pressure. Most double entry doors have an active and an inactive door leaf. The dead bolt is usually located in the active door and it uses the inactive door as the point to which it is secured. It is this point at which the greatest weakness exists. To improve the stability of the fixed door, strong slide bolts should be added to the top and bottom of the doors. Make sure that these bolts have long enough throws to extend a minimum of 1" into the header above door and into the floor construction or threshold. Reinforcing bolt kits are also available. Check with your local home improvement store to find out what type of bolting system will work for your doors.

For additional information...

Department of Emergency Management:

http://www.floridadisaster.org/mitigation/rcmp/hrg/content/openings/entry_doors.asp

Section 3:

CATEGORIES OF MITIGATION OPTIONS: GARAGE DOORS

Photos Courtesy of Laura Lee Corbett

HISTORICAL SIGNIFICANCE

Historic garage doors are typically character defining elements in the facades of historic buildings. Whether there is one single large door on a home, or a series of doors creating a rhythm across the building elevation of a carriage house, firehouse or warehouse, they are important to the historic character of the structure. Inappropriate replacement of these doors can detract from the historic integrity of the building. For instance, a historic carriage house would be adversely affected by replacement of the decorative historic doors with modern garage doors.

TREATMENT OF HISTORIC GARAGE DOORS

When repairing or altering a historic garage door, one should avoid removing historic materials and features that are in good condition. To the extent possible, required alterations should be reversible. The garage door's original frame and trim should be preserved along with original associated features such as glazing and hardware. Replacement should be limited to severely deteriorated components. Assure that the frames and doors have proper maintenance, regular painting, and that caulking and weather stripping is applied as necessary. Removal of earlier, inappropriate repairs is encouraged and the original or similar finish should be maintained.

PROTECTION

Garage doors are typically highly vulnerable to hurricane force winds because of the substantial width of opening that they cover, usually the single biggest opening on a building. The strength of a garage door is very important to the survival of a structure. Two car garage doors are more vulnerable to high winds than single-wide garage doors. Older garage doors and new ones that are not pressure rated are highly susceptible to wind damage, including buckling, twisting off the tracks and failure due to impact from windborne debris. Doors can be pushed in by winds or pulled out as winds whip around the corner of a building where the door is located.

MITIGATION TREATMENTS

WHEN WORKING WITH *HISTORIC* DOORS, THE FOLLOWING IS RECOMMENDED:

Interior Bracing

Historic garage doors should be retrofitted at the interior. Alterations that would change their exterior appearance should be avoided. Vertical bracing systems can be effective for supporting the door against wind pressure loading. An acceptable retrofit includes installation of a removable vertical post or posts (attached to the wall at the head of the opening and also to the floor) subdividing the width of the door(s). The door(s) must be securely attached to these posts so as to withstand both positive and negative wind pressures. The garage door track may also need to be retrofitted with heavier hardware and improved attachment to the door frame. Another type of supplemental reinforcing includes metal stiffening angles which can be permanently attached to the interior of the door(s).

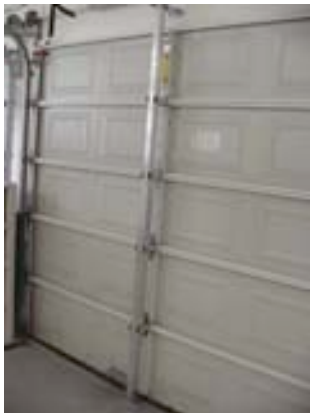


Photo Courtesy of Secure Door

This telescoping vertical brace made of aluminum that attaches to the inside of the largest opening in most homes is available at local home centers. It is suitable for use with practically any garage door without modifying the garage door itself.

Illustration Courtesy of Institute for Business & Home Safety

Flexible Wind Abatement Systems

There are several new plastic mesh curtain products that may have application in protecting large door assemblies like garage doors. Typically these products are attached to a series of hooks or loops in a metal track anchored above the opening to be protected. The bottom of the curtain is commonly anchored to the ground a distance away from the base of the wall and stretched tight. The flexible wind abatement system is designed to stretch a pre-calculated amount to allow for the deceleration and deflection of wind-borne debris.

Panel System

Another solution for protecting the garage door is to construct and install a protective storm panel system that completely covers the garage door opening. The panel product must be rated for both wind pressure and debris impact. Garage door panel construction is identical to the construction and installation for a window. However, the extra span needs to be considered and supported as if it were a large window. Storm panels are a very effective way to protect a garage door because they are easy to deploy. Usually garage door panels attach along the top and bottom of the door opening. Please see the doors and windows sections of this manual for more information on these systems.

Plywood Panels

While not necessarily code compliant, plywood panels are often used to protect window and door openings and can significantly increase survivability in the absence of other protective measures. One of the easiest and most effective ways to provide protection, plywood panels must be prepared in advance so they can be easily installed during a hurricane threat. In

protecting a garage door opening, the most effective plywood panel installation is one that employs a 2 X 4 stud frame (constructed in front of the doors) to support the plywood panels. Installation requires bolts, wood or masonry anchors, large washers, and 5/8-inch exterior grade plywood. Installation does result in some damage to the building fabric which will require repair after the panels are removed.

WHEN WORKING WITH *HISTORIC* FEATURES, THE FOLLOWING IS NOT RECOMMENDED:

Horizontal Bracing

Horizontal bracing of overhead rolling doors with wood members is rarely very effective and usually not a good idea. Some existing garage doors can benefit from permanent, light weight metal horizontal bracing. Permanently installing large wood members on such doors will change the balance of the door and can make it so heavy that the garage door does not lift easily. Temporary horizontal bracing and or heavy drop bolts can be used to secure historic side swinging and side-swinging sectional folding garage doors.

Impact Resistant Glass & Window Film

Reglazing a historic garage door with impact resistant glass is generally discouraged due to its thickness (9/16"impact glass vs. 3/16" single strength historic glass). While it may be possible to retrofit some types of historic garage doors with this specialty glass, most glazed doors are not able to accommodate impact resistant glass. This is because the historic glazing stop and rabbet are not deep enough to keep the glass in the openings. A retrofit of this nature cannot be accomplished without permanent modification of the historic garage door. Generally, such modification is inconsistent with recommended preservation practices.

Window film retrofits are generally discouraged as well. Much like a broken windshield, these film systems do not prevent the glass from breaking. Rather, they hold the glass together but will not keep it in place unless overlapped with film covering the frame and a portion of the glass. While such film installations would help protect a building's interior, its effectiveness would be limited by the strength of the garage door glazing framing.

WHEN WORKING WITH *NON-HISTORIC* FEATURES, THE FOLLOWING IS RECOMMENDED:

All recommended treatments above in addition to the following:

Replacement Doors

In the case where historic garage doors are deteriorated beyond repair, or have already been replaced with inappropriate modern garage doors, any new treatments should be compatible with the historic character of the building. When replacement is necessary, the original garage doors location, shape, panel configuration and size should be maintained. The new replacement doors should match as closely as possible the architectural detailing and material of the original door. If the design of the original garage doors is not known, the new replacement doors should compatible with the historic character of the building.

If the historic doors are irreparable or missing, garage doors with impact resistant glass are available in a variety of sizes and light configurations. Several manufacturers produce modern garage doors that replicate the appearance of historic garage or carriage house doors. Typically made of aluminum to resist rot and pest infestation, impact resistant garage doors are also available for some styles in wood reinforced with metal. These are a desirable alternative to storm panels as a replacement for highly deteriorated garage doors.

The replacement door and its tracks should be code-approved for both wind pressure and impact protection required for the area in which you live.

WHEN WORKING WITH *NON-HISTORIC* FEATURES, THE FOLLOWING IS NOT RECOMMENDED:

Installation of modern garage doors that are inconsistent with the historic character of the property.

Don't forget...

Backing a vehicle against the garage door provides little additional resistance to high wind forces/damage. It may help the bottom panel resist inward forces, but will do nothing to protect from outward forces.

For additional information...

Staveteig, Kaaren R. *New Infill for Historic Garage Openings.* Washington, D.C.: June 1999, ITS Number 2, Technical Preservation Services, National Park Service, U.S. Department of the Interior. http://www.nps.gov/history/hps/tps/tax/ITS/its_02.pdf

Department of Emergency Management:

http://www.floridadisaster.org/mitigation/rcmp/hrg/content/openings/garage_doors.asp

FEMA:

http://www.fema.gov/plan/prevent/howto/how2016.shtm

Section 3:

CATEGORIES OF MITIGATION OPTIONS: PORCHES

Photos Courtesy of Laura Lee Corbett

Photo Courtesy of Florida Department of State

Tie rods were installed behind the historic cast iron columns of Building 34, the 1873 Bachelor Officer's Quarters at NAS Pensacola, to provide uplift resistance to the historic wrap-around porch.

HISTORICAL SIGNIFICANCE

Due to our sub-tropical climate, porches are important character-defining features to many historic Florida residences. Having served a practical function in the era before air conditioning, porches often possess decorative details that contribute to a structure's style. For example, full façade front porches with classic symmetry and pediments are often a hallmark of the Greek Revival style, while highly decorative asymmetrical wrap around porches are common to the Queen Anne style, and arcaded porches are indicative of the Mediterranean Revival style. Porch supports in and of themselves often impart much of the structure's overall style and should not be replaced. Examples include the square columns and sloping or battered piers associated with the Craftsman and Prairie styles, the classic order columns of the Greek Revival and Neoclassical styles, and the turned posts and spindles found in the Folk Victorian and Queen Anne styles. Even the most modest of vernacular houses will have a porch.

TREATMENT OF HISTORIC PORCHES

Enclosing or removing historic porches is generally discouraged as the various projections on a building, such as porches and the recesses or voids in a building, such as open galleries, arcades, or recessed balconies add to overall visual character. Protecting and preserving historic millwork features found on porches such as posts, brackets, spindlework and balustrades is important. Character defining porch supports should be retained if possible. If replacement is required, the new supports should match the appearance (and ideally the material) of the original features. For instance, delicate cast iron supports would not be an appropriate replacement for heavy, squared piers on a Craftsman style residence. The addition of porch elements for which there is no historical basis on the structure, such as decorative brackets, is inadvisable as well.

PROTECTION

Failures of porches during severe weather occur frequently and can cause tremendous damage to the main building. One type of failure occurs when the porch pulls away from the building roof or wall. Another failure occurs when parts of the porch become wind-borne debris and strike the building. Porch roofs are generally constructed in two ways: as an extension of the main roof of the building (incised porch); or, as a separate roof which is relatively independent of the main roof. With an incised porch, there is no transition from the roof covering of the main building and the roof covering of the porch. The concern with an inset porch is that wind may lift the roof off of the main structure. A porch with a separate roof is built similar to an addition to the main structure and is less likely to damage the main structure if its roof should blow away.

For protection of the general structure, reinforce the outer walls at the porch. This includes using metal straps and hurricane clips to connect the porch and main roof framing to the building wall and anchoring the wall to the foundation, thus creating a continuous load path. At the outer edge of the porch, use mechanical fasteners to connect the roof members to the beams, the beams to the columns/posts and the columns/posts to foundation. Toe nailing (the practice of nailing at an angle to the first member to ensure penetration into a second member) of framing is an unacceptable connection method. Porches, especially those with exposed roof rafters and historic millwork (posts, brackets, and balustrades) can be adversely affected by the installation of exposed framing connectors. To the extent possible, straps, post bases and other supplemental framing connectors should be concealed. Do not add layers of new trim to conceal such connectors. Where this is not possible, such connectors should be applied to the back side of beams and otherwise located to minimize their visibility. Where concealment is not possible, a series of connectors should be carefully located and uniformly aligned. All exposed connectors should be painted the same color as the material to which they are applied.

MITIGATION TREATMENTS

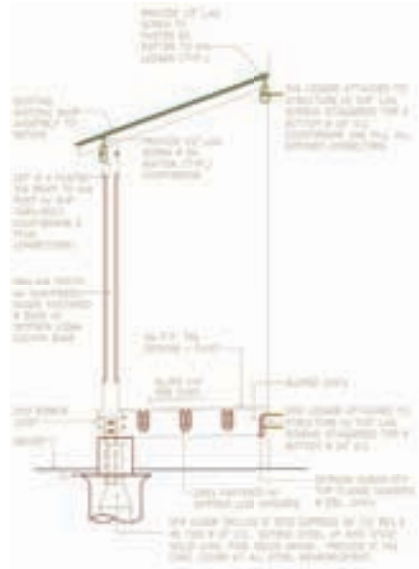
WHEN WORKING WITH *HISTORIC* MATERIALS, THE FOLLOWING IS RECOMMENDED:

Flexible Wind Abatement Systems

There are several new plastic mesh curtain products that may have application in protecting large open areas like open or screened porches, elaborate entry compositions including sidelights and transoms, or the entire sides of buildings. Typically these products are attached to a series of hooks, or loops in a metal track, installed above the opening to be protected. The bottom of the curtain is commonly anchored to an augered anchor a distance away from the base of the wall and stretched tight. Flexible wind abatement systems are designed to stretch a precalculated amount to allow for the deceleration and deflection of impacting missiles. One example is a curtain that extends over an entire structure, anchored to the ground on opposite sides of the structure, providing protection against flying debris while anchoring down the entire building. Sectional curtain type wind abatement systems appear acceptable for use on historic buildings. Those products designed to protect the entire home may be appropriate for buildings with simple roof forms and without features such as dormers and chimneys.

Photo Courtesy of Division of Emergency Management, Bureau of Mitigation

A flexible wind abatement system enclosing an entire porch helps to keep wind and flying debris away from the openings.



Used with permission, Division of Emergency Management, Bureau of Mitigation

Used with permission Bender & Associates Architects

A) This column is held down by two rusty tech screws.; B) This porch on an older Florida house was enclosed. Note that the roof was resting on the brick columns with no anchor to hold the roof down.; C) Porch Roof Connection.

Porch Roof Connection

Individual rafters must be securely anchored to ledgers and beams. Metal hurricane straps are typically used for this purpose. If the porch roofing is being replaced, recessed lag bolts can be used to secure rafters to beams – eliminating the need for straps. A heavy metal strap at least 1" wide and 1/8" thick connecting the roof structure to the column with nails or screws is ideal. Another heavy metal strap at least 1" wide and 1/8" thick connecting the column to the floor system or foundation will complete the continuous load path. Post bases should be embedded for a flush finish in beams and columns. Post bases should also be embedded in the post for a flush finish. This strap should be either embedded in the foundation or connected to the wood floor framing system with nails or screws. These preengineered straps should be installed in strict accordance with manufacturer's recommendations. Another option is to thread a rod up through the column with a steel plate and large nut holding down the roof structure. The rod is then anchored into the foundation. To strengthen the connection, check the size of the foundation where the column will be anchored. Usually manufactured hardware is readily available for such a retrofit, but in some cases a creative alternative will need to be developed.

WHEN WORKING WITH *HISTORIC* MATERIALS, THE FOLLOWING IS NOT RECOMMENDED:

Installation of hurricane straps in highly visible locations is discouraged, as is replacement of historic porch posts, framing, finishes and decorative features in implementing mitigation measures. New applied trim elements should not be used to conceal straps or other improved connections.

WHEN WORKING WITH *NON-HISTORIC* MATERIALS, THE FOLLOWING IS RECOMMENDED:

In the case where a historic porch is deteriorated beyond repair, or has been replaced with inappropriate construction, new code-compliant porch construction should match the appearance of the historic porch, with all required connections and anchors concealed. Ideally, the material used in this new construction should match the historic work. If the design of the historic porch is not known, the new porch should be compatible in design with the historic character of the building.

WHEN WORKING WITH *NON-HISTORIC* MATERIALS, THE FOLLOWING IS NOT RECOMMENDED:

New porch construction that is not compatible with the historic character of the property should be avoided.

Don't forget...

Landscape Features

Landscape features can be important to the interpretation of historic properties. The species of trees and plant materials often provide a context to the historic resource. However, trees also present a hazard if they snap and limbs fall on the structure during a high wind event. Even their roots can damage foundations, sidewalks or driveways. The selective pruning of weak or diseased limbs can maintain the health of trees. When planting new landscaping, insure that all trees are far enough away from a structure so that they can't fall on it.

If the area immediately surrounding a historic building contains outbuildings, trash cans, yard debris, or other materials that can be moved by the wind, the building will be more likely to be damaged during a hurricane or tornado. The wind can pick up smaller objects and drive them through windows and glass doors. Storage sheds and other outbuildings should be securely anchored, either to a permanent foundation or with straps and ground anchors. Similar anchors should be used to secure pad mounted air conditioning equipment. Smaller objects, such as trash cans, barbecue grills, and outdoor furniture should be moved indoors in preparation for a storm.

Photo Courtesy of Florida Department of State

Here is another view of the tie rods installed behind the cast iron columns of Building 34, the 1873 Bachelor Officer's Quarters at NAS Pensacola, to provide uplift resistance to the historic wrap-around porch.

For additional information...

http://www.floridadisaster.org/mitigation/rcmp/hrg/content/features/features_index.asp

http://www.blueprintforsafety.org/windprotection/wpextstruct.aspx

Section 3:

CATEGORIES OF MITIGATION OPTIONS: WALLS & FOUNDATIONS

Photos Courtesy of Manausa Lewis & Dodson Architects

HISTORICAL SIGNIFICANCE

Walls provide support for the roof and upper floors. They also protect the interior of a structure from the elements. In many cases, such as the wood frame house, these functions are separated; structural support is provided by vertical wooden members while an exterior covering, or cladding, screens the interior. Many historic structures in Florida are built of balloon frame construction. This method incorporates closely spaced (16" to 24" on center) two inch thick studs and rafters with nailed connections. Studs extend from foundation to roof with the floor joists hung upon them. Historic cladding for wood frame construction can include horizontal or vertical boards, wood shingles, stucco, or brick or stone veneer. Early wooden walls were often supported by a series of posts or blocks made of rot resistant wood, or masonry piers. These foundations were designed to raise the walls from the underlying soil, thus providing protection from the damp earth and storm water. In Florida's sub-tropical climate, they also provided important air circulation to naturally cool and ventilate the structure. Wood walls were also supported by continuous masonry foundation walls.

Earlier historic structures sometimes incorporated masonry structural systems of fired brick, or cut and uncut stone. In structures built entirely of these materials, brick and stone serve both functions of support and exterior covering. Materials in the form of fired clay tiles or hollow concrete blocks which developed later, provided a lighter and cheaper alternative to earlier masonry structural systems. Poured concrete walls reinforced with iron or steel bars are common to 20th century commercial buildings. Masonry walls typically require a continuous underlying support, foundations which were generally wider and of heavier materials than the masonry of the overlying walls they supported. Monolithic foundation walls of poured concrete or concrete foundations with block stem walls (reinforced with cells filled) generally began to replace brick, stone and solid concrete block masonry foundation walls around WWII. Piers were eliminated with the use of concrete slab foundations, which were poured under the entire structure for support in mid 20th century Ranch style homes.

TREATMENT OF HISTORIC WALLS AND FOUNDATIONS

Foundation piers constructed of wood, brick or stone are subject to failure through rot, settlement, deterioration of mortar joints or connectors. Ideally the latter problem can be avoided through regular maintenance. If severe deterioration is present, repair of perimeter foundation features (i.e. visible piers) should match the historic construction with no visible change. Interior foundation improvements (i.e. those not visible) may be of contemporary construction engineered for the application. Infill between exterior piers should match the documented historic treatment. Typically, this was with some form of wood lattice. Masonry infill between piers is not recommended. Historic wall cladding materials should be retained and preserved. The use of materials not found on a structure historically should be avoided. For instance, covering horizontal boards with aluminum or vinyl siding is inappropriate, as is replacing historic wood siding with fiber cement siding. Unique wall features such as decorative shingle patterns and stucco finishes should be retained and maintained. Wood elements should be firmly attached to the structure and painted for protection from the elements. Masonry veneers should be securely anchored to the underlying structure. If such a veneer is loose or delaminating, professional assistance should be sought to select the appropriate method of reattachment. Failure to address this type of deterioration allows water entry and can lead to more severe structural deterioration. A maintenance regimen of selective repointing of deteriorated mortar joints will assure long term integrity of load bearing masonry or veneers.

PROTECTION

Walls have to resist the uplift forces caused by high wind as they are the structural link between the roof and the foundation. Walls must maintain a continuous load path to resist these forces through the use of metal connectors for wood frame construction. Masonry construction should incorporate a bond beam at the top of the wall.

The lateral force of the wind will push the walls in and pull them out from the building. Walls must be secure enough to resist this push and pull effect. For wood frame construction, studs have to be sized and spaced to resist the lateral forces, and have to be securely supported at the top and bottom plates and through well-attached shear walls. Concrete block masonry resists the lateral forces by using reinforcement in grouted cells that extend from the bond beam to foundation.

In addition to wind forces, storm surge can weaken foundations and overturn walls. No matter the type of foundation construction, adequate connections between the wall and foundation are essential if the structure is to resist storm surge and the various types of wind loading. Install wall-to-foundation connections using brackets or straps between the wall framing and the foundation to strengthen connections. The sill, or bottom member of the wall frame, should be bolted to the foundation and studs should be strapped to the sill as well as the horizontal plate at the top of the wall. Again, connection designs must create a continuous vertical load path throughout the wall system. Pre-engineered straps, plates and other connectors are available for such improvements. They should be installed in accordance with manufacturer's recommendations and in such a manner to minimize loss or change in appearance of original materials and features.

Photos Courtesy of Manausa Lewis & Dodson Architects

A) Front Elevation of Ringling Ca d'Zan.Gatehouse; B) Rafter tie down straps/anchors in masonry wall; C) Rafter tie down straps/anchors. 1926 Ringling Estate, Ca d'Zan, Sarasota

MITIGATION TREATMENTS

Connections (straps, clips and other connectors) installed to improve anchorage of roof framing to walls and walls to foundation should be concealed. Existing exterior finishes should be carefully removed and reinstalled to accomplish installation. If these connections can be installed at the same time as reroofing, a small area of the roof deck can be removed at the wall line to facilitate installation of the required straps – without affecting interior or exterior finishes.

Gable End Walls

Bracing of gable ends is encouraged. In most cases bracing of gable ends can be accomplished without affecting historic finishes and with only minor modification of the historic roof framing system. To the extent possible, supplemental framing required for this work should leave the historic framing intact. In interior spaces with exposed roof framing, supplemental framing should be designed to minimize its visual and physical impact, and should be compatible with but clearly distinguishable from the historic structural system.

Piers

Many historic structures are built on raised piers, which provide weight to resist overturning, sliding, and uplift loads. Check for proper anchors and reinforcements when evaluating adequacy. The piers should be well maintained and severe signs of weakening should not be present. If piers are in adequate condition but the floor framing is not connected to the piers, connectors must be installed. These should be concealed. If piers require repairs or replacement, they should match the dimensions of the historic piers if visible. New piers that are not visible may be of contemporary construction. In all cases, structural alterations and improvements should be designed by an architect or structural engineer to assure structural integrity and code compliance.

Masonry Foundations

The most common anchoring system for wood walls and wood floor systems to foundations is the use of metal straps or connectors. These straps and connectors are easily attached to masonry foundations with masonry screws or bolts. It is important to install these products following manufacturer's recommendations.

Slab On Grade

A slab on grade foundation is a single, continuous layer of concrete with turned-down edges that sits directly on the ground and acts as the floor and foundation system. A slab-on-grade foundation is typically reinforced with welded wire fabric and longitudinal steel reinforcement (rebar) in the perimeter footing or turndown and elsewhere where it supports load-bearing partitions. For wood-framed construction, the bottom plate of the wall should be anchored to the slab with anchor bolts and washers. In order to retrofit, drill through the wall's sill plate into the concrete slab to anchor the wood-framed walls. Install 5/8" retrofit anchors with minimum 3"x3"x1/8"; washers every 16 inches and within a foot of each corner. Again, it is important to install these products following manufacturer's recommendations. Threaded rods set in epoxy adhesive are

Photos Courtesy of Manausa Lewis & Dodson Architects

A) 1937 Maddox House in Port St. Joe; B) Sill Beam Tie Downs Trap to New Masonry Piers

also used for this type of retrofit.

For concrete block masonry construction, vertical reinforcement in a continuously grouted cell should extend from the wall above and be embedded in the concrete footing below with a standard hook. Historic concrete structures may lack this reinforcing. In the absence of such reinforcing, several proven engineering solutions are available; however, these must be designed on a case-by-case basis.

Don't forget...

Flood Mitigation

Photo Courtesy of Scott Edwards

Blessed Sacrament

Standing water from heavy rains and storm surge may weaken the walls, ceilings, and floors of a structure. In flood-prone areas install "check valves" in sewer traps to prevent flood water from backing up into the drains. Construct barriers such as levees, berms, or floodwalls to stop floodwater from entering the building. Products designed to seal basement walls can adversely affect some historic masonry. Consider alternative means such as flood shields or flood walls to protect historic basements. These should be designed to be compatible with the historic construction and landscape development on the site. In the absence of such permanent protective measures, sandbags should be installed around windows, doors, foundation vents, etc., below flood level. The likelihood of damage from a storm surge to a property can be determined by flood elevation maps, which are maintained at your local government planning office.

For additional information...

Division of Emergency Management:

http://www.floridadisaster.org/mitigation/rcmp/HRG/content/structural/gable_end_walls.asp

Blue Print for Safety:

http://www.blueprintforsafety.org/windprotection/wproofwall.aspx
http://www.blueprintforsafety.org/windprotection/wpframing.aspx
http://www.blueprintforsafety.org/windretrofit/wrkeephouse.aspx

Jim Sewell, Richard Wagner, Claudette Hanks Reichel; ***Treatment of Flood-Damaged Older and Historic Buildings: 2005 National Trust for Historic Preservation***

Section 4:

PRODUCTS

Photo Courtesy of (A) Bender & Associates Architects; (B) 1000 Friends of Florida; (D) Florida Trust for Historic Preservation, Inc.; (C & E) Laura Lee Corbett

METAL ROOFS

Photo Courtesy of Bender & Associates Architects

The Key West Custom House shows several significant historic metal roofing conditions. The lower roof is standing seam painted red, the upper roof is Victorian shingles painted red. Gutters and fascia trim are copper and were fabricated to match the historic configuration.

DESCRIPTION:

- Prefinished high strength steel or aluminum roofs protected by various anti-corrosion coatings.
- Offered in a broad palette of colors and several gauge options.
- Available in individual interlocking Victorian style shingles, batten or ribbed, and standing seam.
- Some metal panels give the appearance of tile, shake, slate, and shingle.
- Painted aluminum panels recommended for sea salt spray conditions.

INSTALLATION:

- All endlaps require sealant. Use sealant tape in all sidelaps for critical weather-tightness.
- Verify minimum slope requirement to ensure proper drainage.
- Some roof conditions, such as valleys, may require a longer endlap and/or a larger flashing to properly drain moisture from the roof.

ARCHITECTURAL STYLE APPROPRIATE:

- Standing seam batten or 5-vee panels for folk houses such as Cracker and foursquare Georgian, Folk Victorian, and Agricultural buildings.
- Some historic metal panels replicating tiles for Mediterranean Revival, Italian Renaissance, Mission, Spanish Eclectic, Monterey, Prairie, and Craftsman.
- Some metal panels replicating shingles appropriate for Greek Revival, Gothic Revival, Queen Anne, Folk Victorian, Colonial Revival, Craftsman, and Prairie.
- Requires verification of historic use on the structure.

POTENTIAL OPTION FOR:

Doors
Windows
✓ Roofs
Porches
Garage Doors

RECOMMENDED:

- Use on appropriate architectural styles in a pattern and color consistent with historical use.
- Metal panels giving the appearance of tile, shake, slate, and shingle should be used only when consistent with a historic use.
- Nails, screws or fasteners should be corrosion resistant and match the roof color.

NOT RECOMMENDED:

- Do not use batten or standing seam on structures to replace the historic use of a shingle, shake or tile roof.
- Do not use metal panels with the appearance of tile, shake, slate, and shingle to replace the historic material.
- Some metal panels with a stone coated finish give the appearance of tile, shake, slate, and shingle. They are not recommended for historic buildings.

INTERNET SEARCH TIPS:

- Miami-Dade Product Search: Try an Advanced Search, Category: Roofing; Subcategory: All; Material: Aluminum, Copper, Steel
- Florida Building Code Product Approval: Try search using Category: Roofing; Subcategory: Metal Roofing

SEE FOR YOURSELF:

Photos Courtesy of Bass Construction

Old City Waterworks

City of Tallahassee

Randolph G. Lewis, AIA
Manausa Lewis & Dodson Architects, Inc.

850.385.9200

Manufacturer: Berridge Manufacturing Company
Austell, Georgia

Product Model: Victorian Shingle

Metal shingle roofing installed on 1923 Waterworks building.

TILE ROOFS

DESCRIPTION:

Photo Courtesy of Laura Lee Corbett

The 1926 Colony Hotel, Delray Beach

- Available in clay, ceramic, composite, and concrete.
- Tile systems include Spanish (Mission), Roman, and shingle tile.
- Available in a wide variety of colors.
- Concrete tile reproduces the general look and profile or proportions of historic clay tile, at a somewhat lower cost; however, this material is not recommended for replacement of historic clay tile.

INSTALLATION:

- Systems of interlocking tile units secured by non-corrosive nails or screws.
- Anchor to meet current code requirements which usually involve extra fasteners and foam adhesives.
- Insure that tiles are installed in a manner that water does not easily get underneath the tile.
- High profile mission tiles should be installed with weather blocking at hips, ridges and head-walls which may consist of metal, mortar, preformed plastic, or pressure-sensitive adhesive rolls. Exposed elements should match the tile material and finish.
- Mortar/grout should match the color of the historic grout used on the roof (typically natural mortar color).
- Use 20 oz. soft temper copper hurricane clips for high wind specifications.

ARCHITECTURAL STYLE APPROPRIATE:

- Mediterranean Revival, Italian Renaissance, Mission, Spanish Eclectic, Monterey, Prairie, and Craftsman.
- Requires verification of historic use on the structure.

POTENTIAL OPTION FOR:

Doors
Windows
✓ Roofs
Porches
Garage Doors

RECOMMENDED:

- Use on appropriate architectural styles in a pattern and color consistent with historical use.

NOT RECOMMENDED:

- Asphalt shingles are an incompatible replacement substitute for the original clay tile roofing.
- Do not use tile options that replicate the look of stone, slate or wood shingles.
- Do not use stone coated metal panel systems replicating the look of clay tile.
- Unless consistent with a historic use, painted finish metal panel systems replicating the look of clay tile are inappropriate.

Photo Courtesy of Laura Lee Corbett

Not Recommended – Asphalt shingles are an incompatible replacement substitute for the original clay tiles on this residential garage.

INTERNET SEARCH TIPS:

- Miami-Dade Product Search: Try an Advanced Search, Category: Roofing; Subcategory: Roofing Tiles; Material: Concrete, Cement, Composite, Clay
- Florida Building Code Product Approval: Try search using Category: Roofing; Subcategory: Roofing tiles.

SEE FOR YOURSELF:

Photo Courtesy of Main Street Ft. Pierce

Old City Hall
Downtown Fort Pierce
Anne W. Satterlee, City of Fort Pierce
772.460.2200
Manufacturer: Ludowici Roof Tile
Product Model: Ludowici Cubana Tapered Mission tiles

Tiles installed on historic 1925 City Hall are a color mixture or "blend" of 40% Clay Red, 20% 165-01, 20% Impressionist Tuscany, 10% Empire Green with Ebony Mist and 10% Brookville Green-High Gloss.

Stuart Welcome Arch
NE Dixie Highway at NE Cardinal Ave, Stuart
Bonnie C. Landry, Martin County
772.288.5456
Manufacturer: Zion Tile Corporation
Product Model: Barrel Alhambra

Tiles installed on historic 1926 Welcome Arch.

SEE FOR YOURSELF:

Photos Courtesy of REG Architects, Inc.

Harriet Himmel Gilman Theater for Cultural and Performing Arts
CityPlace, Downtown West Palm Beach

ARCHITECT:

Rick Gonzalez, AIA
REG Architects, Inc.
307 Evernia St., Fourth Floor, West Palm Beach FL 33401
561.659.2383 ext. 17
rick@regarchitects.com
www.regarchitects.com

Manufacturer: AltUSA, 6801 N.W. 77th Ave., Suite 301, Miami, FL 33166
Product Model: "Barrel Tile" with the color mixture of 60% red, 20% peach, and 20% brown

Clay tile roofing installed on the Harriet Himmel Gilman Theater for Cultural and Performing Arts originally built in 1926 as the First United Methodist Church.

SHAKE AND SHINGLE ROOFS

DESCRIPTION:

- Available in asphalt, composite, slate, synthetic and wood. Also available in aluminum, copper or steel metal panels.
- Styles include cedar shakes and shingles, diamond and scalloped shingles. Some synthetic options replicate the look of stone, slate or wood shingles.
- Available in a wide variety of colors.
- Steel metal panel systems replicate the look of wood or slate with various coatings; please refer to the metal roofs section.

ASPHALT INSTALLATION:

- Follow shingle installation procedures for enhanced wind resistance.
- Shingle-over ridge vents will compromise the impact resistance classification.

Photo Courtesy of Laura Lee Corbett

Installation of an asphalt shingle roof.

SLATE INSTALLATION:

- The old slate should be carefully removed. Stripping should be done in sections, with felt installed, to avoid exposing the entire subroof to the weather.
- Terne coated stainless steel (TCS) and copper are ideal for flashing.
- Reinstall salvaged slate and supplement as needed with new matching material.

SHINGLE INSTALLATION:

- The specifications should describe special features important to the roof. Swept valleys, combed ridges, or wedged dormer cheek runoffs should each be detailed with the patterning of the shingles and the placement of flashing or other unseen reinforcements.
- Paper coated and reinforced metal laminated flashing gives added protection over eaves and other vulnerable areas.
- Adhesives give a stronger attachment at projecting roofing combs that could blow away in heavy storms.
- Ideally one third of each shingle should be exposed (exposure dimension should match historic installation) and will assure adequate coverage.
- See manufacturer's special application requirements for high wind areas/zones.

ARCHITECTURAL STYLE APPROPRIATE:

- Requires verification of historic use on the structure.
- Wood shingles appropriate for Carpenter Gothic, Queen Anne, Folk Victorian, Vernacular, Colonial Revival and Tudor Revival.
- Wood shakes are appropriate for Folk Victorian and Vernacular.
- Slate is appropriate to the Mansard roofs of the Second Empire style, the steeply pitched roofs of the Gothic Revival and High Victorian Gothic styles, and the prominent roof planes and turrets associated with the Queen Anne style. Also appropriate for Tudor style and Collegiate Gothic style buildings.

POTENTIAL OPTION FOR:

Doors
Windows
✓ Roofs
Porches
Garage Doors

RECOMMENDED:

- Use on appropriate architectural styles in a pattern and color consistent with historical use.
- The configuration, massing, and style of historic roofs are important design elements that should be preserved. When repairing or replacing a roof, original details affecting its visual character should be retained.
- Slate roof repair is viable for localized problems and damaged roofs with reasonably long serviceable lives remaining. If 20% or more of the slates on a roof or roof slope are broken, cracked, missing, or sliding out of position, it is usually less expensive to replace the roof than to execute individual repairs. If replacement is requried consider one of the artificial slate products currently available (some have a 50 year warranties).

NOT RECOMMENDED:

- Significant slate and shingle roofs should not be stripped off and replaced with asphalt shingles.
- For wood shingles and shakes, avoid inadequate coverage, staples and inferior flashing.
- Where visible at eaves or occupied interior spaces, avoid patching deteriorated roof lath or sheathing with plywood or composite materials.
- The application of roofing mastic or sealants to damaged slates should not be considered a permanent repair treatment because these materials will eventually harden and crack, thereby allowing water to enter.
- Ferrous metal fasteners may corrode, thus allowing slates to slide out of position. Generally, use corrosion-resistant fasteners and fasteners compatible with roofing and flashing materials.

SEE FOR YOURSELF:

Photos Courtesy of Florida Trust for Historic Preservation, Inc.

Hays-Hood House

Caroline Tharpe Weiss
Florida Trust for Historic Preservation

850.224.8128

Manufacturer:
Watkins Sawmills LTD, Sumas, Washington, USA / Mission, British Columbia, Canada

Product Model:
WS Certi-Split White Cedar Shakes

Cedar Shakes

Cedar shakes installed on 1910 Queen Anne home.

The Grove

Photos Courtesy of Manausa Lewis & Dodson Architects

Dave Ferro
Florida Department of State

1.800.847.7278

Manufacturer: EcoStar

Product Model: Federal Gray Majestic Slate

Synthetic

Slate composite installed on c. 1830 Greek Revival home.

INTERNET SEARCH TIPS:

- Miami-Dade Product Search: Try an Advanced Search, Category: Roofing; Subcategory: Asphalt Shingle, Roofing Slate, Wood Shingles and Shakes, Material: Aluminum, EPDM, Composite, Organic, Plastic
- Florida Building Code Product Approval: Try search using Category: Roofing; Subcategory: Asphalt Shingles, Metal Roofing, Roofing Slate, Wood Shingles and Shakes

HURRICANE STRAPS/CLIPS

DESCRIPTION:

- Installed between the roof framing and the walls to strengthen connections and prevent roof failure due to the negative wind pressures.
- Effective at reducing high wind damages.
- May not prevent damage if connections are not designed to resist coastal flood forces as well as high wind pressures.
- Most connections and fasteners will require some level of maintenance.

INSTALLATION:

- Install between the roof framing and the walls, and between trusses and walls.
- Connections must be designed to ensure a continuous load path throughout the building.
- The correct number of specified fasteners (length and diameter) must be used with connection hardware.
- Must be installed according to the manufacturer's or engineer's specifications.

ARCHITECTURAL STYLE APPROPRIATE:

- Does not require verification of historic use on the structure.

POTENTIAL OPTION FOR:

Doors
Windows
✓ Roofs
✓ Porches
Garage Doors

RECOMMENDED:

- Use corrosion resistant connectors and fasteners to maximize effectiveness.

NOT RECOMMENDED:

- Avoid cross-grain tension in connections and machine nailing of fasteners.

INTERNET SEARCH TIPS:

- Miami-Dade Product Search: Try an Advanced Search, Category: Fasteners; Subcategory: Wood Connectors, Material: Steel
- Florida Building Code Product Approval: Try search using Category: Structural Components; Subcategory: Wood Connectors

Hurricane clips

Photos Courtesy of The Historic Florida Keys Foundation

Hurricane straps

Photos Courtesy of Manausa Lewis & Dodson Architects

FLEXIBLE WIND ABATEMENT SYSTEM

DESCRIPTION:

- Flexible wind abatement system with transparent plastic mesh designed to withstand hurricane winds without rupture while deflecting small and large missiles.
- Fabric is typically sewn at the border of the screen and different attachment systems are used to secure the fabric to the walls of a building.
- Generally allows visibility and natural light into protected structures while mitigating high winds and driving rain intrusion.
- Fits most types of openings including large window compositions, arches, gingerbread, porches and unique architectural features.
- Lightweight and can be easily stored.

INSTALLATION:

- Attachment systems include buckle/strap, direct grommet, and track.
- Fabric is typically attached to a series of hooks or loops in a metal track anchored above the opening to be protected. The bottom of the curtain is commonly anchored to the ground a distance away from the base of the wall and stretched tight.

ARCHITECTURAL STYLE APPROPRIATE:

- Any architectural style as a temporary option.
- Does not require any verification of historic use on the structure.

POTENTIAL OPTION FOR:

✓ Doors
✓ Windows
✓ Roofs
✓ Porches
✓ Garage Doors

RECOMMENDED:

- Permanent elements of the attachment system should be physically and visually unobtrusive to the building.

NOT RECOMMENDED:

- Full building wrap systems are not appropriate for use on historic buildings with roof features such as dormers and chimneys.

INTERNET SEARCH TIPS:

- Google search: Hurricane Fabric, Hurricane Netting, Flexible Wind Abatement Systems

Photo Courtesy of Phoenix Architectural Products, Inc.

Flexible wind abatement system installation.

ROOF STRAPS OR HARNESSES

DESCRIPTION:

- A system of pre-installed grounded anchors positioned around the base of building (or in the foundation) to which pre-fitted straps or harnesses are attached and ratcheted tight prior to a forecasted storm event. They serve to help counteract the uplifting wind forces resulting from tornados or a hurricane.

INSTALLATION:

- Both anchors and straps are fitted and pre-installed to meet the dimensions of a particular building; the straps are taken down and stored for future use in the event of a forecasted storm event.
- Businesses or home owners, or their contracted-service providers, can deploy the harnesses over the building, attaching them to the pre-installed anchor points, then removing them after the storm to be stored away.
- Anchors can be attached in a variety of ways, such as directly to the building foundation, (concrete slabs, masonry walls, piers, wood pylons) or to concrete ground anchors pre-installed around the base of the structure (these can be concealed beneath sprinkler system-like yard caps).
- Installations may vary depending on the various roof styles and designs.

ARCHITECTURAL STYLE APPROPRIATE:

- Any architectural style where the building is unsecured by other means. Does not require any verification of historic use on the structure.
- Requires no significant building alterations.
- Unobtrusive appearance when used appropriately.

POTENTIAL OPTION FOR:

Doors
Windows
✓ Roofs
✓ Porches
Garage Doors

Photos Courtesy of Hurricane Harness, Inc.

A) Roof straps installed on a home.; B) Roof strap anchor.

RECOMMENDED:

- Temporary option for a building that is unsecured or not permanently anchored to the foundation.
- Anchoring systems are physically and visually unobtrusive.
- Consider the use of a harness system, rather than just straps on structures with significant tiles, shingles or metal roofs.
- Locate underground lines and pipes before anchor installation. If unsure of the presence of underground lines or pipes, contact your local utility provider or contractor.
- Should not be used in place of permanent passive solution such as hurricane clips where these can be installed as a permanent part of the structure.

NOT RECOMMENDED:

- Straps may bend or break historic roofing materials, and may not be suited to unique forms of historic roofing.

INTERNET SEARCH TIPS:

- Google, Yahoo, Msn search:
  Hurricane Home Protection
  Hurricane Roof Protection
  Hurricane Roof Harnesses or straps
  Hurricane Harness

Section 5:

LIST OF CERTIFIED LOCAL GOVERNMENTS

Photo Courtesy of (A) Main Street Ft Pierce; (B) Bass Construction; (C) University of West Florida Archeology Institute; (D & E) REG Architects, Inc.

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Photo Courtesy of Koreshan State Historic Site

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Photo Courtesy of Ray Stanyard

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