

HURRICANE RESEARCH ADVISORY COMMITTEE



REPORT TO THE FLORIDA BUILDING COMMISSION

October 13, 2009

Tampa, Florida

Facilitation, Meeting and Process Design By



CONSENSUS CENTER

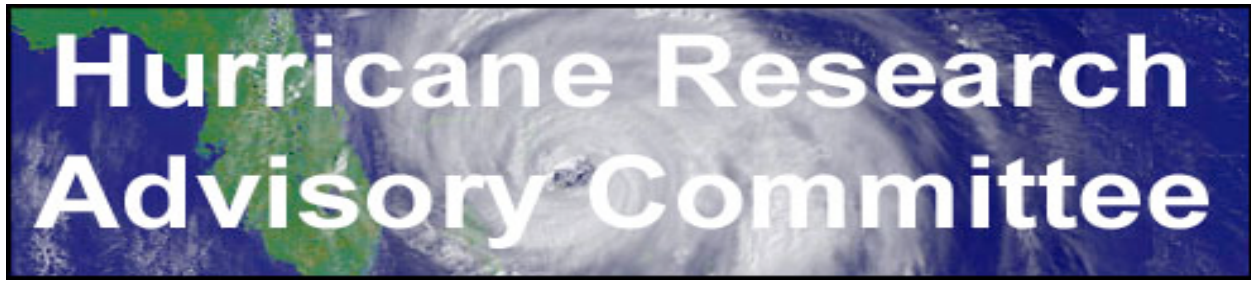
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FLORIDA BUILDING COMMISSION



Overview and Project Scope

At the January 26, 2005 Commission meeting, Chairman Raul L. Rodriguez, AIA appointed a small coordinating group consisting of Commissioners and other stakeholder representatives, charged with identifying what research is being conducted related to building failure issues resulting from the 2004 hurricanes, identifying any research gaps on key issues identified but not being researched, and finally, to ensure that the Commission is provided with all relevant research findings on each of the major issues, prior to the Commission considering code enhancements resulting from lessons learned.

The Hurricane Research Advisory Committee (HRAC) meets on an ongoing basis for the purpose of receiving updates on current research initiatives, providing recommendations on needed research projects and funding for same, and providing recommendations regarding proposed code amendments relevant to hurricane and storm protection enhancements.

Raul L. Rodriguez, AIA, Chair of the Florida Building Commission, made the following appointments to the Hurricane Research Advisory Council. Members are charged with representing their stakeholder group's interests, and working with other interest groups to develop a consensus package of recommendations for submittal to the Florida Building Commission.

Members and Representation

Raul L. Rodriguez, AIA, Chair

Chris Schulte

Do Kim, P.E.

Jim Schock, CBO

Jaime Gascon

Craig Parrino, P.E.

Tim Reinhold, PhD, P.E.

Joe Crum, CBO (President, BOAF)

Jack Glenn, CBO

Dave Olmstead

John Ingargiola

Richard Reynolds

Architects

Roofing contractors

Insurance industry

Building officials

Local government

Product manufacturers (concrete products)

Insurance industry/Researchers

Building officials

Home builders

Product manufacturers (windows)

Federal government (FEMA)

Insurance Industry

REPORT OF THE OCTOBER 13, 2009 MEETING

Opening and Meeting Attendance

Chairman Raul L. Rodriguez, AIA, welcomed participants and opened the meeting at 1:00 PM.

The following Workgroup members were present:

Raul L. Rodriguez, AIA, Chair, Joe Crum, Do Kim, Jaime Gascon, Jack Glenn, John Ingargiola (Tom Smith alternate), Dave Olmstead, Craig Parrino, Tim Reinhold, Richard Reynolds, Jim Schock, and Chris Schulte.

Members Absent

None.

DCA Staff Present

Rick Dixon, Mo Madani, and Jim Richmond.

Meeting Facilitation

The meeting was facilitated by Jeff Blair from the FCRC Consensus Center at Florida State University. Information at: <http://consensus.fsu.edu/>



Project Webpage

Information on the project, including agenda packets, meeting reports, and related documents may be found in downloadable formats at the project webpage below:

<http://consensus.fsu.edu/FBC/hrac.html>

Agenda Review and Approval

The Workgroup voted unanimously, 8 - 0 in favor, to approve the agenda as presented including the following objectives:

- To Approve Regular Procedural Topics (Agenda and Summary Report)
- To Hear Report on FMA Window/Wall Standards
- To Review 2010 FBC Flood Resistant Standards Project
- To Discuss FBC and ASCE 7 Wind Load Requirements for Roof Mounted Equipment
- To Hear a Presentation on FY 2008-2009 Hurricane Resistance Research
- To Discuss Follow-Up Research Supporting Hurricane Resistant Construction Standards Development
- To Discuss 2010 FBC Amendments Initiatives of Commission Workgroups
- To Consider Public Comment
- To Identify Needed Next Steps: Information, Assignments, and Agenda Items for Next Meeting

December 8, 2008 Facilitator's Summary Report Review and Approval

Jeff Blair, Commission Facilitator, asked if any members had corrections or additions to the December 8, 2008 Report, and none were offered. The Workgroup voted unanimously, 8 - 0 in favor, to approve the December 8, 2008 Facilitator's Summary Report as presented.

FMA Report on Window/Wall Standards

Dick Wilhelm, FMA, provided the Committee with an update on FMA/AAMA and FMA/WDMA Window Wall standards and answered member's questions. Following the presentation there was an opportunity for questions and answers and a discussion. The public was included in the discussions and provided opportunities to comment.

Members were provided copies of FMA/AAMA 100-07 "*Standard Practice for the Installation of Windows with Flanges or Mounting Fins in Wood Frame Construction*".

In addition, copies were provided of two (2) FMA/WDMA draft standards, as follows:

FMA/WDMA 250-XX "*Standard Practice for the Installation of Windows with Non-Frontal Flanges for Surface Barrier Masonry Construction for Extreme Wind/Water Conditions*", and

FMA/AAMA 200-XX "*Standard Practice for the Installation of Windows with Frontal Flanges for Surface Barrier Masonry Construction for Extreme Wind/Water Conditions*".

Presentation and Discussion on FBC and ASCE 7 Wind Load Requirements for Roof Mounted Equipment

Overview:

Broward County Board of Rules and Appeals (BORA) sent a letter to 59 air-conditioning manufacturers to ensure they were aware of the Florida Building Code's wind load requirements for mechanical equipment exposed to the wind. A copy of the Commission's final order on Declaratory Statement DCA-08-DEC-205 clarifying that pursuant to section 301.13 Florida Building Code, Mechanical Volume: "mechanical equipment, appliances and support that are exposed to wind shall be designed and installed to resist the wind pressures on the equipment and the supports as determined in accordance with the Florida Building Code, Building. This may be accomplished by design or by application of Section 301.13.1 Roof-mounted mechanical units and supports shall be secured to the structure. The use of wood "sleepers" shall not be permitted." was also sent. BORA reported that only three (3) manufacturers responded, none of which they felt demonstrated compliance with the requirements of the Code.

At the June 2009 meeting, Broward County Board of Rules and Appeals (BORA) requested that the Commission address issues regarding the Mechanical Code's requirement for mechanical equipment exposed to wind to be designed for wind resistance. The Commission issued a declaratory statement (DCA08-DEC-205) addressing this issue and verifying that this provision of the Code applies. BORA indicated that they contacted manufacturers none of whom have equipment that complies with the relevant provisions of the Code and that building departments do not appear to be enforcing the provision. Representatives of BORA requested that the Commission contact manufacturers to ensure they comply with the Code on this issue.

Subsequently, Chairman Rodriguez sent a letter to the Air-Conditioning, Heating, and Refrigeration Institute. The letter stated:

RE: Florida Requirements for the Hurricane Resistance of Outdoor Mounted HVAC Equipment

You are aware, one of the major problems Florida must address is hurricane protection. Hurricanes have devastated areas of Florida, damaged its economy and created property insurance crises since the early 1990's. In response, the Florida Legislature enacted the state

developed Florida Building Code (the Code) and used it to address hurricane damage to buildings. The Code in turn has addressed numerous building weaknesses including outdoor mounted WAC system components.

While the Florida Code has led the advancement of hurricane protection requirements it is not alone in addressing the potential damage to buildings resulting from equipment that breaks loose from its attachment to structures. The American Society of Civil Engineers, Standard 7 also currently provides criteria, which we understand will be even more directive in the next edition. Some WAC equipment manufacturers have responded to the codes and standards requirements however of concern are code enforcement jurisdictions' reports that most have not demonstrated their products meet appropriate standards. The Florida Building Commission is responsible for working with industries, building officials and other interests to develop and update the Code. A dialog with your industry, local jurisdictions and insurance industry interests would be a constructive approach to address the compliance concern. I propose that we arrange a meeting of the parties to discuss how industry and government can move forward together and request that you identify and coordinate participation of your manufacturer members' representatives.

The Commission referred this issue to the HRAC so they could work with stakeholders to ensure that the wind-load requirements of the Code are being complied with and to evaluate issues and options for ensuring same.

At the October 2009 HRAC meeting there were multiple presentations on this topic as follows:

Jim DiPietro, BORA, summarized the issues contained in the letter sent to manufacturers from BORA. See Overview provided above for details.

Rick Dixon, FBC Executive Director, provided an overview of the Commission's involvement with the issue to date. See Overview provided above for details.

Tom Smith, FEMA, provided an overview of hurricane damage assessments regarding roof mounted equipment.

(Attachment 2—FEMA Presentation Summary)

Mo Madani, FBC Codes and Standards, provided a summary of relevant code provisions and declaratory statements. Mo reviewed relevant provisions of the 2007 Florida Building Code: Building, Residential and Mechanical volumes.

(Attachment 3—FBC Requirements)

Summary of Comments and Discussion:

- JG: does FEMA have code proposals to ICC to correct this issue?
- TS: no, the requirements are clear and adequate, issue is designers should specify the correct attachments and manufacturers should demonstrate that panels are attached correctly and meet the requirements of the code.
- Chuck Meyer: tie-downs are addressed, if manufacturers design equipment to withstand the wind, what happens if installers don't replace panel screws to the correct torque standards. This is the problem, we can certify compliance with how equipment is engineered, but we can't control and should not be responsible for what happens in the field.

- RR: all equipment/products have same issue, not unique to mechanical equipment. Policing unit once installed is always a problem.
- TS: panels that can't be removed are also lost, access panels are an issue too. Job site modifications creates problems, using carabineers on latches to keep closed is better than thumb screws.
- Do Kim: understand manufacturers issue, but no different for all manufacturers like window/shutter/soffit that have to meet wind-load requirements and they also have no guarantee the installer will do job correctly, manufacturer has to design equipment to the wind load requirements of the code, period.

Public Comment:

- Few manufacturers responded to BORA's requests, they addressed only slab on ground mounting, not roof mounted equipment or unit integrity, and would not send test reports to verify equipment complies with wind-load requirements of the Florida Building Code.
- Larry Means: servicing of equipment is not done always by licensed contractors, policing workforce is not realistic. If you place straps over panels so they can't be easily serviced, they won't be replaced correctly by service workers, can't ensure the issue will be corrected by designing to code, so waste of time to design to the Code. The problem is the market determines manufacturers most cost effective equipment, can't design cooling towers to 150 mph winds.
- Rafael Palacios: cooling tower manufacturers have done good job, we know how to attach equipment, issue is the panels on the actual equipment aren't designed correctly.
- Do Kim: cooling towers manufacturers provide certified drawings no problem, so why should HAVC manufacturers not have to comply.
- Pat Laughlin: AHRI, how can manufacturers satisfy Florida that their equipment complies with code, we need to maintain control over our documents. The HRAC could develop standards, we do want to establish an avenue to communicate.
- Dave Stevens: there is a disconnect: manufacturers understand the issue is industry competition and don't want to give competitors documentation, sharing information is the problem. Also, levels and types of communications from locals is conflicted, what information is needed (calculations).
- We are willing to work with FBC, and not resistant to working this issue out.
- RD: proprietary documents/calculations are important and standards could help.
- Chris Schulte: package units are not subject to Rule 9B-72 requirements, so product approval won't completely resolve this issue.
- MM: stands approved by PA system, the units are not.
- DK: similar to PA for solar collectors, external equipment, but approved by product approval (PA), attachment to roof is issue: test standards or rational analysis, same as roof mounting of solar collectors.
- Ted : willing to comply with requirements, who do we certify to? Local, state, etc.. Comply with code, now more strict and requires documentation.
- RD: if equipment required PA, then state approval is accepted state-wide.
- RP: NOA not accepted by Coral Gables, needed engineers calculations.
- DK: manufacturers late to product approval, need to get equipment approved state-wide.
- CP: marketing issue, who wants to comply first and get it done, worried about competition, should use 9B-72, Product Approval, to address this issue.
- Jaime Gascon: PA is always required, calculations are reviewed by the structural reviews, PA could be solution from residential to commercial. This is not a testing issue, products are made with conventional materials, standards are already in the code.

Presentation on FY 2008-2009 Hurricane Resistance Research

Forrest Masters, Kurt Gurley, and David Prevatt, University of Florida Department of civil and Coastal Engineering, provided the Committee with an update on current UF hurricane related research initiatives and answered member's questions. Following the presentation there was an opportunity for questions and answers and a discussion. The public was included in the discussions and provided opportunities to comment.

Summary of PowerPoint Presentation:

Overview of 2008-2009 Research Activities:

- Resistance of residential window glass to lightweight windborne debris
- Resistance of steel and aluminum storm panels to roof tile impacts
- Structural and WDR resistance of soffit
- Water penetration resistance of field and factory mulled window units
- Primary and secondary roof cover

Water Penetration Resistance of Residential Window Installation Options for Hurricane-Prone Areas:

- Water intrusion through fenestration openings was well documented in the damage assessments following the 2004-2005 hurricane seasons.
- Window installation methods are adapting different techniques to manage intruding water
- The effectiveness of these methods has not been tested under the extreme wind-driven rain conditions to which they are subjected to during their service life
- Through the use of the static and dynamic pressure load simulators, the water penetration resistances of active and proposed installation standards were tested under three different pressure loadings sequences with simulated wind-driven rain

Comparison of Wind-Driven Rain Test Methods For Residential Fenestration:

- WDR events were simulated using a pressure chamber, in which full-scale residential wall systems were subjected to uniform, linearly varying, and cyclic pressure loads while the façade was wetted.
- The specimens were also subjected to dynamic loads using a new turbulent wind load simulation apparatus developed at UF

Resistance of residential window glass to lightweight windborne debris:

- Experimental investigation of the momentum threshold required to damage window glazing when impacted by roof shingles and wooden dowels
- Shingles are among the most common sources of debris in hurricane winds, and have been observed to be a major contributor to the breach of windows.
- Wooden dowels represent lightweight vegetation type windborne debris (e.g., twigs, branches).

Structural and WDR Resistance of Residential Soffits:

- The University of Florida began working with the University of Western Ontario to develop a High Flow Pressure Loading Actuator (HFPLA). This was based off UWO's smaller PLA used in the Three Little Pigs Project to test various building products. This HFPLA was used to run a dynamic trace on various soffit types to test installation methods. The dynamic trace is based on actual wind tunnel data.

Primary and Secondary Roof Cover:

- Status: Achieving desired flow conditions and assessing sensitivity to environment and configuration

Water Penetration Resistance of Field and Factory Muller Units:

- UF has extended its full-scale experimental procedures to include the water penetration resistance of factory and field muller window units.
- During UF's regular meetings with its Research Task Force Committee water these issues were scheduled to be tested following the conclusion of its initial fenestration projects 1 and 2

Ongoing / Future Research:

1. Hurricane field reconnaissance / post-storm damage assessments
2. Airflow mapping over residential / commercial roofs using PIV in the wind tunnel
3. ccSPF (RCMP and Sea Grant)
4. CSIPS (UAB project; sponsored by NSF)
5. WDR projects (sponsored by RCMP)
 - a. Development of a wind-driven rain map for Florida (ARA)
 - b. Development of a unified engineering basis for the assessment of the resistance of Florida residential building envelopes to severe wind-driven rain (UF)

Comparison of Wind Tunnel Modeling of Observed Hurricane Wind Loading on Residential Structures:

Objectives

- To conduct a multi-facility wind tunnel study of the loads on residential structures in extreme winds
- To develop accurate ground level wind field turbulence models in a variety of heterogeneous terrains typical of near-coast residential construction.
- Both of these objectives will utilize thousands of hours of field data collected during U.S. land falling hurricanes since 1999. This existing dataset includes both wind field measurements (velocity) collected by portable towers deployed in coastal and inland/suburban settings, and pressure data measured on the roofs of 12 near-coast real, occupied residential structures, six of which experienced hurricane winds.

(Attachment 4—HRAC Proposed Amendments)

Discussion on Follow-Up Research Supporting Hurricane Resistant Construction Standards Development

Rick Dixon requested that the HRAC consider options to provide funding for research projects relevant to the Committee's scope, and to support funding that is able to leverage larger funding amounts than invested to receive them. The HRAC's recommendations will be submitted to the Florida Building Commission.

Overview:

Research was begun on roof coverings and components during 2008-2009 in response in part to the Legislature's Hurricane Mitigation (Roofing) Initiative and in part as extension of the Wind-Borne Debris Studies begun in prior years. The studies included construction and testing of large scale model roof samples at the UF hurricane simulator test facility and testing of soffit components of the roof system. Experimental work also was conducted in wind tunnel test facilities via contract with UF that evaluated wind pressures on roof systems and roof component failure. Results of these

tests verified the under-prediction of wind forces at roof edges by the ASCE 7 design standard and demonstrated the acceleration nature of roof cladding failures.

The study of roof component and cladding and roof attached structures and equipment must be conducted by various hurricane wind effects simulation methods. The beginning point of any such simulation studies is accurate characterization of the wind field and its effects. Then simulation models can be constructed to test various components and attachments. Research conducted in response to the 2004 and 2005 hurricanes has been directed primarily to window and wall components and cladding. Work was begun last year on roof systems. Current year funding will be directed to supporting studies to characterize the wind field on roofs and to leveraging funding for roof systems related research provided by federal organizations including FEMA/DHS, NOAA/Sea Grant and RCMP/DEM.

The DCA has spending authority identified in the legislature approved budget for hurricane related research in FY 2009-2010 that comes from fees collected by DBPR and transferred to DCA for research and from building permit surcharge fees. However, it anticipates encumbering just half the spending authority this year dependent upon the status of fee collections by next spring.

Following question and answers, an opportunity for public comment, and Committee discussion, the HRAC took the following action:

Committee Action:

Motion—The HRAC voted unanimously, 9 - 0 in favor, to support DCA funding research projects that leverage the funding of other agencies for projects that support resolution of Florida hurricane related building failures.

Review of 2010 FBC Flood Resistant Standards Project

Jeff Blair, Commission facilitator and facilitator of the Flood Resistant Standards Workgroup, provided members with an overview of the project and relevant recommendations and answered member's questions.

Jeff reported that the following ten (10) consensus recommendations have been adopted by the Florida Building Commission:

- 1. The I-Code provisions should be used as the basis for inclusion of flood provisions relevant to buildings and structures into each of the respective codes (FBC). Members agreed that on balance, ICC provisions should be retained unless there is a specific need for a Florida Specific Requirement.*
- 2. Adopt ASCE 24 (Flood Resistant Design and Construction Standards) by reference as the flood provisions in each of the codes (FBC).*
- 3. Allow local jurisdictions to adopt higher standards for flood resistance provision to address local concerns within the Code (based on local flood studies), to ensure local's ability to be eligible for the NFIP's Community Rating System.*
- 4. Seek a legislative exception so that local CRS (higher flood resistant standards) would not be subject to the local technical amendment requirements of the Code, subject to a consistency review with updated editions of the code.*
- 5. Develop a model "companion" ordinance that includes NFIP-consistent administrative provisions and includes NFIP requirements for development other than buildings and structures that are not within the scope of the Code. Also, include a list of more stringent requirements that local jurisdictions could consider for possible adoption.*

6. *Inconsistencies between the CCCL and V Zone requirements shall continue to be resolved at the local level, and on a case-by-case basis.*
7. *A interagency group should be formed to develop a strategy for determining whether any inconsistencies between the CCCL and V Zone requirements can be resolved by code changes in the next code cycle (i.e., coordination between FBC, DEP, DEM, FEMA).*
8. *Adoption of flood maps and administrative procedures shall be at the local level.*
9. *Retain ICC format, modify as appropriate for Florida and develop cross-reference list, similar to Chapter 27 for the Electrical Code.*
10. *Seek statutory change to section 553.80 F.S. to clarify that this provision not be used to deviate from flood resistant requirements.*

The Workgroup's complete package of recommendations and relevant project documents may be viewed and/or downloaded at the project webpage as follows:

<http://consensus.fsu.edu/FBC/Flood-Resistant-Standards.html>

Discussion of 2010 FBC Amendments Initiatives of Respective Workgroups

Soffit Systems Workgroup

Jeff Blair, Commission facilitator and facilitator of the Soffit Systems Workgroup, provided members with an overview of the project and relevant recommendations and answered member's questions.

Jeff reported that the Workgroup has adopted the following package of consensus recommendations:

Workgroup's Consensus Labeling Recommendations:

Conceptual support for a soffit system labeling requirement in the Florida Building Code.

- Label should be on the packaging with some tie-back method to the installed product.
- Members agreed that for manufactured products with State approval the following is required on the label: Manufacturer's name; model number or name; FL number, NOA, or some reference number that correlates the product to its product approval number providing traceability.
- Manufacturing facility's city and state should be on the packaging label.

Product Labeling

The Workgroup agreed unanimously, 14 -0 in favor, to the following regarding soffit system product/piece labeling requirements for manufactured products in the Florida Building Code, as follows:

Individual soffit pieces shall be marked at not more than four foot on center with a number/marking that ties the product back to the manufacturer.

Packaging Labeling

The Workgroup agreed unanimously, 14 -0 in favor, to the following regarding soffit system packaging labeling requirements for manufactured products in the Florida Building Code, as follows:

1714.8.2 The following information shall be included on the labels on impact-resistant coverings:

1. Product approval holder/manufacturer name and city and state of manufacturing plant.
2. Product model number or name.

3. Method of approval and approval numbers as applicable. Methods of approval include, but are not limited to: Miami-Dade NOA, Florida Building Commission FL #, TDI Product Evaluation, and/or ICC-ES.
4. The test standard or standards specified in Chapter 14 used to demonstrate Code compliance.

The Workgroup's complete package of recommendations and relevant project documents may be viewed and/or downloaded at the project webpage as follows:

<http://consensus.fsu.edu/FBC/soffit.html>

Window Wall Workgroup

Jeff Blair, Commission facilitator and facilitator of the Window Wall Workgroup, provided members with an overview of the project and relevant recommendations and answered member's questions.

Jeff reported that the Workgroup has adopted the following package of consensus recommendations:

1. *Reorganize the code sections to split curtain wall from garage door requirements.*
2. *Add requirement to Chapter One, plan review requirements, detail through wall penetrations for fenestrations for both commercial and residential plans.*
3. *Include a standard detail for each type of installation and place in the code commentary.*
4. *106.3.5 Minimum plan review criteria for buildings. The examination of the documents by the building official shall include the following minimum criteria and documents: a floor plan; site plan; foundation plan; floor/ roof framing plan or truss layout; all fenestration penetrations; flashing; and rough opening dimensions and all exterior elevations.*

The Workgroup's complete package of recommendations and relevant project documents may be viewed and/or downloaded at the project webpage as follows:

<http://consensus.fsu.edu/FBC/wwg.html>

General Public Comment

Members of the public were invited to provide the Workgroup with comments.

There were no general public comments provided. Members of the public were provided opportunities spoke on each of the substantive discussion issues before the Workgroup.

Next Steps

The Workgroup will continue meet as needed to review research project updates, provide recommendations on needed research projects and funding for same, and provide recommendations regarding proposed code amendments relevant to hurricane and storm protection enhancements

Adjourn

The Workgroup voted unanimously, 9 - 0 in favor, to adjourn at 3:30 PM.

ATTACHMENT 1
MEETING ATTENDANCE—PUBLIC

Public Meeting Attendance	
NAME	REPRESENTATION
Dick Wilhelm	FMA/WDMA
Rafael Palacios	FBC
Tom Smith	FEMA Mitigation
Chuck Meyer	FRHCCA
Bob Boyer	FBC
John O'Conner	BOAF
Steve Strawn	Jeld-Wen Windows
C.W. Macomber	APA

ATTACHMENT 2

FEMA PRESENTATION SUMMARY

Performance of Rooftop Equipment During Hurricanes Presentation Summary:

Presentation Topics:

- Equipment Integrity
 - Hoods, Enclosure & Access Panels
 - Fan Cowlings & Relief Air Hoods
 - Vibration Isolators
- Equipment Attachment
- Topic presented to ASHRAE in 2005

Performance Typically Poor:

- Documented as far back as 1989 (Hugo)
- Documented in Numerous Hurricanes in Geographically Diverse Areas
- MAT Observations: No Significant Performance Improvement Since 1989

Ramifications of Poor Performance:

- Loss of Equipment Function
- Water Leakage
- Puncture of Roof Membrane
- Windborne Debris (Property Damage, Injury)
- Loss of Building Function

FEMA MAT Reports:

- Hurricane Charley: FEMA 488
- Hurricane Ivan: FEMA 489
- Hurricane Katrina: FEMA 549
- Hurricane Ike: FEMA P757
- www.fema.gov

FEMA Design Guides:

- Recommendations for Equipment Integrity & Attachment:
- FEMA 543: Critical Facilities
- FEMA 577: Hospitals

ATTACHMENT 3

FBC EQUIPMENT WIND RESISTANCE REQUIREMENTS

2007 Florida Building Code Wind Resistance Requirements for Air Conditioning Equipment and Appliances

Summary:

Florida Building Code, Mechanical
Section 301.12 Wind Resistance.

Requires equipment and appliances to comply with the Florida Building Code, Building.

Florida Building Code, Building
Section 1609.1.1 requires determination of wind loads in accordance with Chap 6 of ASCE 7-2005.

ASCE 7-2005
Section 6.5.15.1 establishes the method for determining wind loads on rooftop equipment.

The relevant sections of the codes and standards are given below:

2007 Florida Building Code, Mechanical

301.12 Wind resistance. Mechanical equipment, appliances and supports that are exposed to wind shall be designed and installed to resist the wind pressures on the equipment and the supports as determined in accordance with the Florida Building Code, Building. Roof mounted mechanical units and supports shall be secured to the structure. The use of wood "sleepers" shall not be permitted.

2007 Florida Building Code, Residential

M1307.2 Anchorage of appliances. Appliances designed to be fixed in position shall be fastened or anchored in an approved manner. Strapping shall be at points within the upper one-third and lower one-third of the appliance's vertical dimensions. At the lower point, the strapping shall maintain a minimum distance of 4 inches (102 mm) above the controls.

M1307.3 Wind resistance. Mechanical equipment, appliances and supports that are exposed to wind shall be designed and installed to resist the wind pressures on the equipment and the supports as determined in accordance with the Florida Building Code, Building.

2007 Florida Building Code, Building

1609.1 Applications. Buildings, structures and parts thereof shall be designed to withstand the minimum wind loads prescribed herein. Decreases in wind loads shall not be made for the effect of shielding by other structures. All exterior wall coverings and soffits shall be capable of resisting the design pressures specified for walls for components and cladding loads in accordance with Section 1609.1.1.

1609.1.1 Determination of wind loads. Wind loads on every building or structure shall be determined in accordance with Chapter 6 of ASCE 7. Wind shall be assumed to come from any horizontal direction and wind pressures shall be assumed to act normal to the surface considered.

ASCE 7-05

6.5.15 Design wind Loads on Other Structures. The design wind force for other structures shall be determined by the following equation:

$$F = (qz)(GCf)(Af)(1b)(N)$$

Where

qz = velocity pressure evaluated at height z of the centroid of area A_f using exposure defined in Section 6.5.6.3

G = gust-effect factor from Section 6.5.8

C_f = force coefficients from Figs. 6-21 through 6-23

A_f = projected area normal to the wind except where C_f is specified for the actual surface area, ft. sq.

6.5.15.1 Rooftop Structures and Equipment for Buildings with $h \leq 60$ ft. The force on rooftop structures and equipment with A_f less than $(0.1Bh)$ located on buildings with $h \leq 60$ ft shall be determined from Eq. 6-28, increased by a factor of 1.9. The factor shall be permitted to be reduced linearly from 1.9 to 1.0 as the value of A_f is increased from $(.01Bh)$ to (Bh) .

Additional Background Information Relating to HVAC Equipment Construction Design:

1609.1 Applications. Buildings, structures and parts thereof shall be designed to withstand the minimum wind loads prescribed herein. Decreases in wind loads shall not be made for the effect of shielding by other structures.

All exterior wall coverings and soffits shall be capable of resisting the design pressures specified for walls for components and cladding loads in accordance with Section 1609.1.1.

1609.1.1 Determination of wind loads. Wind loads on every building or structure shall be determined in accordance with Chapter 6 of ASCE 7. The type of opening protection required, the basic wind speed and the exposure category for a site is permitted to be determined in accordance with Section 1609 or ASCE 7. Wind shall be assumed to come from any horizontal direction and wind pressures shall be assumed to act normal to the surface considered.

ASCE 7 -05

Other structures include: Chimneys, Tanks, Rooftop Equipment & Similar Structures "Figure 6-21".

Chapter 1, of ASCE 7 - 05 defines "Other structures" to mean structures, other than buildings, for which loads are specified in this standard

SECTION 1602 DEFINITIONS AND NOTATIONS

OTHER STRUCTURES. Structures, other than buildings, for which loads are specified in this chapter.

1601.1 Scope. The provisions of this chapter shall govern the structural design of buildings, structures and portions thereof regulated by this code.

1604.1 General. Building, structures and parts thereof shall be designed and constructed in accordance with strength design, load and resistance factor design, allowable stress design, empirical design or conventional construction methods, as permitted by the applicable material chapters.

1604.2 Strength. Buildings and other structures, and parts thereof, shall be designed and constructed to support safely the factored loads in load combinations defined in this code without exceeding the appropriate strength limit states for the materials of construction. Alternatively, buildings and other structures, and parts thereof, shall be designed and constructed to support safely the nominal loads in load combinations defined in this code without exceeding the appropriate specified allowable stresses for the materials of construction.

Loads and forces for occupancies or uses not covered in this chapter shall be subject to the approval of the building official.

1604.3 Serviceability. Structural systems and members thereof shall be designed to have adequate stiffness to limit deflections and lateral drift.

1604.3.1 Deflections. The deflections of structural members shall not exceed the more restrictive of the limitations of Sections 1604.3.2 through 1604.3.5 or that permitted by Table 1604.3.

1604.3.2 Reinforced concrete. The deflection of reinforced concrete structural members shall not exceed that permitted by ACI 318.

1604.3.3 Steel. The deflection of steel structural members shall not exceed that permitted by AISC 360, AISI-NAS, AISI-General, AISI-Truss, ASCE 3, ASCE 8, SJI JG-1.1, SJI K-1.1 or SJI LH/DLH-1.1, as applicable.

1604.3.4 Masonry. The deflection of masonry structural members shall not exceed that permitted by ACI 530/ASCE 5/TMS 402.

1604.3.5 Aluminum. The deflection of aluminum structural members shall not exceed that permitted by AA ADM1.

604.4 Analysis. Load effects on structural members and their connections shall be determined by methods of structural analysis that take into account equilibrium, general stability, geometric compatibility and both short- and long-term material properties.

Members that tend to accumulate residual deformations under repeated service loads shall have included in their analysis the added eccentricities expected to occur during their service life.

Any system or method of construction to be used shall be based on a rational analysis in accordance with well-established principles of mechanics. Such analysis shall result in a system that provides a complete load path capable of transferring loads from their point of origin to the load-resisting elements.

The total lateral force shall be distributed to the various vertical elements of the lateral-force-resisting system in proportion to their rigidities, considering the rigidity of the horizontal bracing system or diaphragm. Rigid elements assumed not to be a part of the lateral-force-resisting system are permitted to be incorporated into buildings provided their effect on the action of the system is considered and provided for in the design. Except where diaphragms are flexible, or are permitted to be analyzed as flexible, provisions shall be made for the increased forces induced on resisting elements of the structural system resulting from torsion due to eccentricity between the center of application of the lateral forces and the center of rigidity of the lateral-force-resisting system.

Every structure shall be designed to resist the overturning effects caused by the lateral forces specified in this chapter. See Section 1609 for wind loads, and Section 1610 for lateral soil loads.

1604.8 Anchorage.

1604.8.1 General. Anchorage of the roof to walls and columns, and of walls and columns to foundations, shall be provided to resist the uplift and sliding forces that result from the application of the prescribed loads.

1604.9 Counteracting structural actions. Structural members, systems, components and cladding shall be designed to resist forces due to wind, with consideration of overturning, sliding, and uplift. Continuous load paths shall be provided for transmitting these forces to the foundation. Where sliding is used to isolate the elements, the effects of friction between sliding elements shall be included as a force.

1605.1 General. Buildings and other structures and portions thereof shall be designed to resist the load combinations specified in Section 1605.2 or 1605.3 and Chapters 18 through 23. Applicable loads shall be considered, including wind, in accordance with the specified load combinations. Each load combination shall also be investigated with one or more of the variable loads set to zero.

TABLE 1604.5
OCCUPANCY CATEGORY OF BUILDINGS AND OTHER STRUCTURES
OCCUPANCY
CATEGORY NATURE OF OCCUPANCY

Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to:

- Agricultural facilities
- Certain temporary facilities
- Minor storage facilities
- Screen enclosures

ATTACHMENT 4
HRAC RECOMMENDATIONS FOR CODE CHANGES
TRACKING CHART 2/7/07

Recommendation	Actions	Targeted Code Change	Action Plan and Assignment
A bond break be provided between primary drainage planes and stucco renderings in drained assemblies. In simple terms this will require two layers of building paper or a layer of building paper over a plastic housewrap.	HRAC recommended Expedited Amendment Commission approved Expedited	Expedited Amendments 11/1/05	Completed
The specification, rating and testing of WRB's be consistent with their installed exposure – i.e. tested and rated as part of a stucco assembly. Appropriate performance specifications need to be developed for WRB's used with stucco renderings and the Florida Building Code altered to require them.	HRAC recommended Expedited Amendment Commission approved Expedited	Expedited Amendments 11/1/05	Completed
The Florida Building Code be altered to come into compliance with the International Residential Code to explicitly allow for the construction of unvented roof assemblies.	HRAC recommended Expedited Amendment Commission approved Expedited	Expedited Amendments 11/1/05	Completed
Require application of exterior surface coatings to appropriate standard or manufacturer's specification.	HRAC recommended Expedited Amendment Commission approved Expedited	Expedited Amendments 11/1/05	Completed
Require wood, metal or other structural support "ridge board" for tile attachment methods 1, 2 and 4A	HRAC recommended Expedited Amendment Commission approved Expedited	Expedited Amendments 11/1/05	Completed

Recommendation	Actions	Targeted Code Change	Action Plan and Assignment
Require FBC approved pre-bagged mortar to attach hip and ridge tiles attachment methods 3 and 4B (pre-bagged mortar requirement applies to systems where mortar is the attachment component not systems utilizing ridge board and mechanical or adhesive-set)	HRAC recommended Expedited Amendment Commission approved Expedited	Expedited Amendments 11/1/05	Completed
Require testing of ridge attachment systems according to SSTD 11 to establish wind up-lift resistance.	HRAC recommended Expedited Amendment Commission approved Expedited	Expedited Amendments 11/1/05	Completed
Utilize an additional tile factor of 2-1 above that specified in SSTD 11 or TAS 101 to determine the “allowable overturning moment” or “attachment resistance expressed as a moment (Mf)”	HRAC recommended Expedited Amendment Commission approved Expedited	Expedited Amendments 11/1/05	Completed
Prohibit component substitution without proper laboratory testing and FBC Product Approval	HRAC recommended Expedited Amendment Commission approved Expedited	Expedited Amendments 11/1/05	Completed
Allow hip and ridge attachment systems with demonstrated performance equal or superior to that required by the identified systems	HRAC recommended Expedited Amendment Commission approved Expedited	Expedited Amendments 11/1/05	Completed
Address requirements for installation instructions via Product Approval Workgroup Recommendations	HRAC recommended Expedited Amendment Commission approved Expedited	Expedited Amendments 11/1/05	Completed

Recommendation	Actions	Targeted Code Change	Action Plan and Assignment
The moisture storage capacity of mass walls be increased by providing a “seat” at the base of these assemblies.	HRAC recommended expedited amendment Commission rejected	None	Referred back to FHBA (recommendation was from FHBA water intrusion report)
Define the terms “weather resistant” and “weather protection”	HRAC recommended expedited amendment Commission rejected	None	Referred back to Central Florida BOAF Chapter to pursue its recommendation
Delete the criteria of chapter 14 that deems walls constructed according to the masonry chapter and concrete chapter requirements to be weather resistant.	HRAC recommended expedited amendment Commission rejected	None	Referred back to Central Florida BOAF Chapter to pursue its recommendation
Require compliance with ANSI/SPRI ES-1 for edge flashings and copings.	HRAC recommended expedited amendment Commission deferred to glitch amendments	Glitch Amendments 12/23/06	Completed
Require compliance with ASTM E-1592 for testing the uplift resistance of metal panel roof systems. (Note: Require ASTM E-1592 for structural metal panel roof systems and UL 580 for non-structural metal panel roof systems)	HRAC recommended expedited amendment Commission deferred to glitch amendments	Glitch Amendments 12/23/06	Completed
Require asphalt shingles to comply with UL 2390 testing and rating based on wind speed categories	HRAC recommended expedited amendment Commission deferred to glitch amendments	Glitch Amendments 12/23/06	Completed

Recommendation	Actions	Targeted Code Change	Action Plan and Assignment
Require removal of existing roof covering down to the deck and replacement of deteriorated sheathing in areas where basic wind speed is 110 mph or greater. If existing sheathing attachment does not comply with loads derived from Chapter 16, require installation of additional fasteners to meet the loads.	HRAC recommended expedited amendment Commission deferred to glitch amendments	Glitch Amendments 12/23/06	Completed
Make the requirements of 2001 FBC Section 1522 (Rooftop Mounted Equipment) applicable throughout the state for all wind speeds. Include in Mechanical Volume also.	HRAC recommended expedited amendment Commission deferred to glitch amendments	Glitch Amendments 12/23/06	Completed
Add criteria regarding wind and wind driven rain resistance of ridge vents. Attachment criteria require development but TAS 100A could be referenced for rain resistance.	HRAC recommended adoption in post “expedited” amendment	Deferred to further research	
Criteria for wind resistance of soffits should be developed and added.	HRAC recommended adoption in post “expedited” amendment	Glitch Amendments 12/23/06	Completed Further research also
Criteria for wind-driven rain resistance of soffits should be developed and added.	HRAC recommended adoption in post “expedited” amendment	Long range – post 2007 FBC update.	Conduct R&D to establish criteria. Budget authority requested for 2007-08
Water managed window and door installation requirements be developed and the Florida Building Code altered to require them.	HRAC recommended adoption in post “expedited” amendment	2007 FBC Update 10/1/08	Prescriptive default criteria developed by 3 national window groups and submitted for 2007 FBC Update

Recommendation	Actions	Targeted Code Change	Action Plan and Assignment
Windows and doors be correctly rated and tested according to ANSI/AAMA 101. Muller window units, double windows or composite windows be tested and held to the same requirements as single units.	HRAC recommended adoption in post "expedited" amendment	Glitch	Completed
Water managed window and door installation requirements be developed and the Florida Building Code altered to require them.	HRAC recommended adoption in post "expedited" amendment	2007 FBC Update 10/1/08	Prescriptive default criteria developed by 3 national window groups and submitted for 2007 FBC Update. Not adopted for 2007 FBC
Water managed details for dryer vents, electrical panel boxes, electrical boxes, vent fan hoods be developed and the Florida Building Code Altered to require them.	HRAC recommended adoption in post "expedited" amendment	Long range – post 2007 FBC update.	Conduct R&D to establish criteria. FY 07-08 project.
Remove the partially enclosed design option at the next code cycle.	HRAC recommended adoption in post "expedited" amendment	Special FBC amendment 1/1/07	Automatically enacted by adoption of 2006 IRC as required by 2005 SB 442. Implemented early-Jan 2007 via HB 1-A
Adopt ASCE 24-05 for elevation requirements and flood resistant materials, equipment.	HRAC recommended adoption in post "expedited" amendment	2010 FBC	FEMA and Florida DCA coordination. Special project for 2010 FBC.
Re-evaluate the hazard identification/mapping approaches in Coastal A/V Zones.	HRAC recommended adoption in post "EA"	Out of Commission's jurisdiction	FEMA and Florida DCA coordination. Prepare and submit amendment.
For hurricane shelters and EHPA, adopt wind speed recommended by Florida DCA in the State Emergency Shelter Program and the ASCE 7-02/2001 FBC wind speed map design wind speed plus 40 mph using Performance Criteria 3.	HRAC recommended adoption in post "expedited" amendment	Out of Commission's jurisdiction	Florida DCA, DOE and School Board Association negotiation. Not adopted for 2007 FBC

Recommendation	Actions	Targeted Code Change	Action Plan and Assignment
Pressure relieved/baffled soffit assemblies be developed for vented roof assemblies and the Florida Building Code altered to require them.	HRAC recommended adoption in post "EA"	Long range – post 2007 FBC update.	Conduct R&D to evaluate soffit water intrusion control methods.
It is unlikely that a practical paint specification can be developed in the short term to address micro-cracking stucco issues as the relationships among water vapor permeability, mil thickness and elasticity are not known. It is recommended that these relationships be explored and that until these relationships are understood the Florida Building Code not be altered to require “elastomeric paints” on stucco renderings.	HRAC recommended adoption in post “expedited” amendment	Long range – post 2007 FBC update.	Conduct R&D on water penetration, absorption and transport through concrete and masonry wall assemblies to establish criteria for coatings or other water control measures.
Add technically-based criteria regarding blow-off resistance of aggregate on built-up and sprayed polyurethane foam roofs (Roof Coverings for Roofs with Slopes Less than 2:12).	HRAC recommended adoption in post “EA”	Long range supported by R&D	Conduct R&D to establish criteria.
Develop window water leakage test and performance criteria specific to hurricane prone regions.	HRAC recommended adoption in post “expedited” amendment	Long range supported by R&D	Conduct R&D in support of AAMA standard development. Windows Work Group/UF research project
Develop criteria that pertain to attaching lightning protection systems. Include in the Electrical Volume also.	HRAC recommended adoption in post “EA”	Long range supported by R&D	Support industry standard development activity. Tom Smith/FEMA
Revise the Florida panhandle criteria to match ASCE 7 wind borne debris region.	HRAC recommended adoption in post “expedited” amendment	Legislature must change the law- Done Amend FBC by 7/1/07	Completed <i>(Conducted Study as directed by 2005 Leg. Issue decided legislatively. Code amended effective July 1, 2007.)</i>

Note: *Red text indicates recommendations for expedited amendments to FBC*
Black text indicates deferral to glitch amendment proceeding decided 6/28/05
Blue text indicates deferral to glitch amendment proceeding decided 5/10/05
Purple text indicates Commission deferral of HRAC recommended expedited amendments, to the glitch amendment proceeding.