FLORIDA BUILDING COMMISSION

HURRICANE RESEARCH ADVISORY COMMITTEE

REPORT TO THE FLORIDA BUILDING COMMISSION

MARCH 21, 2006

Tampa, Florida

Meeting Design & Facilitation By

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FLORIDA BUILDING COMMISSION

HURRICANE RESEARCH ADVISORY COMMITTEE REPORT
MARCH 21, 2006

OVERVIEW

At the January 26, 2005 Commission meeting, Chairman Rodriguez 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.

Following is the chronology of events and subsequent Commission actions resulting from the 2004 hurricanes.

- Commission met in Miami on August 29 – 31, 2004 and staff presented early observations from the storm.
- Hurricane Francis hit on September 6, 2004 over Southern Hutchinson Island, Florida.
- Hurricane Ivan hit on September 16, 2004 between Gulf Shores, Alabama and Pensacola, Florida.
- Hurricane Jeanne hit on September 26, 2004 near Stuart, Florida.
- The Commission met on October 18 – 19, 2004, following three additional hurricanes and presented preliminary data collected from the four storms.
- The Commission met on December 6 – 8, 2004 and a hurricane researchers workshop co-sponsored by the Commission and the Institute for Business and Home Safety, was held on December 6, 2004.
- On January 12, 2005 the Florida Homebuilders Association released an assessment report concerning water intrusion during the 2004 hurricanes.
- At the Commission’s January 2005 Commission meeting the Chair convened a workgroup to assist the Commission by ensuring they have all relevant research on each of the key issues identified during the hurricane assessments to assist the Commission with any needed code enhancements.
- At the Commission’s January 2005 meeting, the Florida Home Builders Association presented findings and recommendations regarding water intrusion.
- On March 16, 2005 the Commission held a joint session with the Hurricane Research Advisory Committee and heard presentations and recommendations on studies related to water intrusion, building code performance, roof tiles, and the design of aluminum structures.
• At the May 10, 2005 meeting of the Hurricane Research Advisory Council the committee heard additional presentations and recommendations on water intrusion, and a window assessment failure study. In addition, at the May 10, 2005 meeting of the Hurricane Research Advisory Council, the committee was asked to make the following preliminary determinations relative to the various recommendations: First, based on the studies and related recommendations, do members support the recommendation, and second should the recommendation be recommended for early implementation (as a part of the legislative authorization for expedited code amendment implementation for hurricane related provisions) or should it be reviewed and considered through the regular Commission code amendment process. The HRAC evaluated each of the options and identified a preliminary list of options recommended for expedited code adoption as well as options that were recommended for adoption through the normal code amendment process.

• At the June 28, 2005 meeting of the Hurricane Research Advisory Council the committee was asked to further consider those options that received a consensus for the recommendations and a 50% or greater level of support for expedited code adoption. The HRAC evaluated these as well as additional options identified by members. At the conclusion of the June meeting, the HRAC reached consensus on a package of recommendations for submittal to the Commission. The recommendations were for amendments recommend for expedited code adoption.

• Hurricane Dennis hit on July 10, 2005 in the Western Florida Panhandle region of the State, between Pensacola Beach and Navarre Beach Florida.

• At the August 23, 2005 meeting the HRAC evaluated the issues for consideration during the 2006 annual code amendment process, and identified issues that needed additional information or development prior to developing recommendations and that should be deferred for future code changes.

• The Commission adopted a draft package of code amendments following public comment received during the rule development workshop conducted at the August 2005 meeting.

• Hurricane Katrina landed on August 25, 2005 near the Miami-Dade Broward County Line in Florida, and on August 29, 2005 hit Plaquemines Parish Louisiana just south of Buras La, and again at the Gulf Coast border of Louisiana and Mississippi.

• At the October 10, 2005 meeting members reviewed the results of Commission action regarding expedited code amendments, and reviewed assignments and project status.

• The Commission conducted a rule adoption hearing at the October 11, 2005 meeting, and adopted a final package of expedited Code amendments

• Hurricane Wilma landed on October 24, 2005 near Cape Romano Florida and crossed the Florida Peninsula just north of Palm Beach.

• At the December 6, 2005 meeting, members heard presentations on observations from Hurricane Wilma damage to South Florida.

• At the February 6, 2006 meeting, members reviewed the status of Committee proposed code amendments, heard an update on the Panhandle Windborne Debris Study, and voted to recommend DCA seek funding authority to support completion of a wind and water infiltration testing facility, and for conducting testing specific to building code development.
At the March 21, 2006 meeting members heard an update on the Panhandle Windborne Debris Region Study. Members reviewed the status of the Committee’s hurricane provision recommendations, and identified additional issues that should be evaluated. The Committee offered a list of issues that need additional research and prioritized the issues based on a five-point ranking scale.

MEMBERS AND REPRESENTATION

At the January 26, 2005 Commission meeting, Chairman Rodriguez 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.

Raul L. Rodriguez, AIA, Chair of the Florida Building Commission, has 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.

Raul Rodriguez, AIA, Chair
Chris Schulte
Do Kim, P.E.
Nick D’Andrea, CBO
George Wiggins, CBO
Craig Parrino, P.E.
Tim Reinhold, PhD, P.E.
Joe Crum, CBO (President, BOAF)
Jack Glenn, CBO
Dave Olmstead
John Ingargiola

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)
The Committee over several months developed a consensus package of recommendations for proposed code amendments. The amendments were recommended for expedited adoption, glitch cycle adoption, or future adoption based on the need for additional research and development.

At the August 2005 meeting, the Commission voted on the Committee’s package of recommended expedited code amendments. At the October HRAC meeting, the Committee reviewed the status of their package of recommendations, including Commission actions related to approved expedited code amendments, amendments deferred to the glitch cycle, and proposed amendments that were not approved or deferred. The Committee also heard an overview from the Panhandle Windborne Debris Region Workshop, and an update on the plan for considering the Exposure C definition issue. In addition, the Committee was asked to review assignments and to identify any additional issues and research and development needs.

At the December 6, 2005 meeting the Committee heard an update on discussions regarding the Exposure C definition, and a status report on the Panhandle Windborne Debris Study. In addition, there were presentations from DCA staff, Miami-Dad County Code Compliance, and the Palm Beach County Building Department on observations regarding the impacts and damage to South Florida from Hurricane Wilma.

At the February 2006 meeting members were provided with an update on the Panhandle Windborne Debris Region Study and the Exposure C definition issue. The HRAC discussed research and development needs and voted to recommend that the Commission request that DCA seek additional legislative spending authority to provide financing for the wall of wind facility at FIU, and conducting testing specific to building code development. The proposed funding amount is $500,000.00 (300K for the facility and 200K for testing). The Commission will review specific budget and contract requirements once spending authority is granted, and has no obligation to spend the money.

At the March 2006 meeting members identified and prioritized a list of issues that require additional research and/or development prior to the HRAC evaluation options and making additional recommendations for proposed hurricane related Code amendments. In addition, the HRAC heard an update on preliminary results from the Panhandle Windborne Debris Region Study.

The Committee will meet again at the JULY Commission meeting to receive an update on related projects and status report on Committee issues, and to review member assignments.

Opening and Meeting Attendance
The meeting started at 10:00 AM, and the following Council members were present: Joe Crum, Nick D’Andrea, Jack Glenn, John Ingargiola, Do Kim, Dave Olmstead, Craig Parrino, Tim Reinhold, Chris Schulte, and George Wiggins.
DCA Staff Present
Rick Dixon, Ila Jones, Mo Madani, and Betty Stevens.

Meeting Facilitation
The meeting was facilitated by Jeff Blair from the Florida Conflict Resolution Consortium 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

Meeting Objectives
• To Review and Approve Agenda and February 6, 2005 Report
• To Review Committee Process Plan
• To Review Status of the Panhandle Windborne Debris Issue Legislation and Study
• To Review Status Update on Exposure C Definition Legislation
• To Receive a Presentation and Discuss Long Range Focus on Hurricane Resistance Improvement of the Built Environment and Building Code Optimization
• To Identify and Prioritize Research and Development Needs
• To Consider Public Comment
• To Review next steps and assignments for next meeting

Review and Approval of March 21, 2006 Agenda
The Committee voted unanimously, 8 - 0 in favor, to approve the March 21, 2006 Agenda as presented.

Approval of February 6, 2006 Facilitator’s Report
The Committee voted unanimously, 8 - 0 in favor, to approve the February 6, 2006 Facilitator’s Report as presented.

Status Update on the Panhandle Windborne Debris Issue Legislation and Study
Dr. Larry Twisdale from ARA presented a PowerPoint presentation on preliminary results from the Panhandle Windborne Debris Region study and answered member’s questions.

Summary of Preliminary Results:
Trees reduce windspeeds at the eave heights of houses.
There are pressure reductions from trees with a 30 – 40% reduction for the light tree case, and a 50 – 60% reduction for the medium tree case.
There is less load reductions for two story homes compared to single story homes.
Wind-Borne Debris Criteria for the Florida Panhandle

The project consists of 5 tasks:

1. Wind Loads
2. Model Representative Houses
3. Update/validate Wind-Borne Debris Model
4. Simulate House Performance
5. Quantify Performance, Risks, Benefits, and Costs of Wind-Borne Debris Protection

Tasks 1 and 2 are essentially complete and Task 3 is well underway. Tasks 4 and 5 are expected to begin in early April. The main results will be available in early May and the final report in June.

The objective of the wind load task is to estimate the wind speeds and pressure coefficients on houses located in treed environments. Wind tunnel testing was performed at the University of Western Ontario in December 2005. Seven terrains were tested: open, suburban, and five tree variations. Mean velocity and turbulence intensity profiles were developed for each case. Pressure measurements were made on one and two story model houses. The results of the tests and resulting analysis can be summarized as:

1. Trees significantly reduce wind speeds on houses.
2. While the pressure coefficients are higher, due to increased turbulence intensity, the pressure loads are about 30-50% less than on houses located in suburban locations without tall trees.
3. The reductions in loads are not as great on two story houses as for one story houses.

Six new houses in the Panhandle have been selected for modeling. Each house is being built to the Florida Building Code and has been modeled with a three-dimensional computer model that captures the building geometry and location of all windows and doors. The replacement values of the homes range from about $118,000 to $343,000. The costs of adding wind borne debris protection to the glazed openings of each house is being estimated for the following protection options:

1. Aluminum panel shutters
2. Accordion shutters
3. Impact resistant glass
4. Plywood/OSB wood panels

The wind-borne debris model is being updated to reflect the new load information for houses located in treed environments, characteristic of the Panhandle. New validation work of the model is being done for Hurricane Andrew and Hurricane Charley to compare predicted and field estimated numbers of windows damaged in these storms. Aerial photographs of Hurricane Ivan damage have also been evaluated to characterize typical tree canopy cover and tree blowdown in the Panhandle area.

Once the validation work is complete, the Panhandle homes will be individually analyzed for damage and loss with and without windborne debris protection. Each house will be located on the 110, 120, and 130 mph ASCE- 7 wind speed contours. The damage and loss data will be...
compared with and without opening protection to produce the reduction in loss for opening protection. This data will be evaluated against the cost of opening protection to obtain measures of benefits and costs. Building performance reliabilities will also be estimated.

**Status Update on Exposure C Definition Legislation**
Rick Dixon provided the Committee with an update on the status of discussion regarding the Exposure Category C definition, and answered Committee member’s questions.

**Overview**
This legislative assignment requires the Florida Building Commission to evaluate the definition of “exposure category C” as currently defined in section 553.71(10), Florida Statutes, and make recommendations for a new definition that more accurately depicts Florida-specific conditions prior to the 2006 Regular Session.

The Commission assigned this task to its Hurricane Research Advisory Committee in order to utilize the Committee’s expertise in this subject area. The Commission is considering the recommendation from stakeholders, that in contrast to current ASCE-7 methodology, the default exposure category for Florida should be exposure category B, and clear definitions and criteria will be developed by the Commission in consultation with stakeholders, to define what constitutes Exposure C. These criteria and conditions will include distance factors, the starting point for where to begin measurements, a clear definition of open terrain, and size and density considerations for large development exemptions.

After reviewing the proposed strategy for defining Exposure Category C, the Commission has reached a conceptual agreement with stakeholders on how to revise the definition, and voted unanimously at their February 2006 meeting, to recommend that the Legislature remove the exposure Category C definition from law, thereby authorizing the Commission to adopt a new definition within the Code by rule. The Commission is committed to working with stakeholders to develop consensus on a new definition to be developed and adopted by rule into the Code.

There is current legislation to implement the Commission’s recommendation.

**Long Range Focus on Hurricane Resistance Improvement of the Built Environment and Building Code Optimization: Presentation by Larry Twisdale, PhD, PE and Discussion**
Dr. Larry Twisdale provided a PowerPoint presentation related to recommending a pilot study be contracted to consider as-constructed quality issues, and performance based reliability initiative and loss reduction and hazard related code improvements. ARA’s proposals were included in the issues prioritization exercise.

**FEMA Mitigation Assessment Team Program Presentation**
Tom Smith prepared a presentation on behalf of FEMA with recommendations for additional hurricane provision code amendments. FEMA’s proposals were included in the issues prioritization exercise.
**Research and Development Needs Identification and Prioritization Exercise**

Following are the issues identified for research and development needs. They include recommendations from the HRAC, ARA, FEMA, committee members, staff, and the public:

**UNRESOLVED HRAC RECOMMENDATIONS**

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.

(Provide exception for structural concrete, limit strengthening to perimeter and corners including hip and ridge; does not apply to regular roof repairs)

Make the requirements of 2001 FBC Section 1522 (Rooftop Mounted Equipment) applicable throughout the state for all wind speeds. Include in Mechanical Volume also.

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.

Water managed window and door installation requirements be developed and the Florida Building Code altered to require them.

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.

Pressure relieved/baffled soffit assemblies be developed for vented roof assemblies and the Florida Building Code altered to require them.

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.

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); or prohibition per IBC 2006.

Develop window water leakage test and performance criteria specific to hurricane prone regions.

Develop criteria that pertain to attaching lightning protection systems. Include in the Electrical Volume also.
Additional Study Issues for Hurricane Resistant Construction Requirements

Compatibility of Component and Cladding Combinations in Wind-borne Debris Regions
Certain cladding material develops significant amounts of wind-borne debris at higher wind speeds. Certain cladding materials are more susceptible to wind-borne debris breach and/or damage than others. The issue that must be investigated is whether certain combinations of these materials are an unacceptable risk to life safety and property damage and if so, what improvements to the materials or the composite systems which they are incorporated in are appropriate to limit the risks.

High Wind Driven Water Intrusion through Windows and Doors and Wall Openings
Current standards require water penetration resistance to 15% of rated pressure. Hurricanes can be wet and have long durations with wind speeds generating pressures far in excess of this rating benchmark (Hurricanes Jeanne). Also, the water penetration of window assemblies is driven by pressure pulses resulting from variability in the wind field. Both parameters need to be analyzed for significance in driving the leakage of windows during hurricane events.

ARA Recommendations:

Pilot Study for as-constructed quality.

Performance based reliability initiative and loss reduction and hazard related code improvements.

FEMA Recommendations:

Shingle enhancements edge securement hip, ridge, rakes at 110 mph or greater.

Shingles to require 6 nails at 110 mph or greater. (testing does not evaluate unsealed condition or marginal bond that breaks) Life testing of shingles to determine is sealing is adequate.

Gutter test method for wind resistance.

Roof Tile at 110 mph or greater eave clip each tile at first row along eaves.

Wind dynamics for the eave area (foam in eave).


Vinyl siding revisions to ASTM standards, recommendations to Committee (safety factor, pressure equalization factor, load duration and deflection).

EIFS recommendations to ICC Evaluation Service regarding test standard (load duration and deflection).

Adopt ASCE 24-05 for elevation requirements and flood resistant materials, equipment for FRC.
**Other Recommendations**

Research glass as windborne debris in high-rise roof towers.

Allow for elimination of ventilation of attics

Soffits test methods and design installation for water intrusion

Underlayments better protection from exposure for an extended period of time

Glazing requirements above 60 feet. Ball bearing test simulate at 60 feet?

Multiple planar intersections in roof structures, increase pressure at those points? Pressures and attachments, loads on ridge tiles, does adding nails redirect roof failure?

Types of sheathing on roof decking.

Penthouse construction.

OSB allowed as wind borne debris protection, survive large missile penetration?

Post hurricane statistical sampling.

Self adhering underlayments fastened on top mechanically attached.
**ISSUES PRIORITIZATION RANKING RESULTS FOR RESEARCH AND DEVELOPMENT NEEDS—MARCH 21, 2006**

**Ranking Scale (28 Issues Ranked)**

5=Highest Level of Priority; Urgent; 4=High Priority; 3=Moderate Level of Priority
2=Low Level of Priority; 1=Lowest Possible Priority; Group Should not Pursue

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Public Comments
Members of the public were provided an opportunity to provide general comments. The public was also provided an opportunity to provide input during the issues identification discussion. Following are the Public Comments:

• Licensing issues, who does the work?
• Level of inspections in jurisdictions (liability concerns of roof inspections)
• Length of fasteners penetrate into the roof deck?