



A Resource of the State of Florida

**HURRICANE LOSS REDUCTION  
FOR  
HOUSING IN FLORIDA**

**A Research Project Funded by  
The State of Florida Department of Community Affairs  
Through Contract 02-RC-11-13-00-05-001**

**QUARTERLY REPORT No. 2**  
**For Quarter Ended December 31, 2001**

**DELIVERABLE # 4**  
**DUE BY JANUARY 15, 2002**

PREPARED BY  
THE INTERNATIONAL HURRICANE CENTER  
FLORIDA INTERNATIONAL UNIVERSITY

## **HURRICANE LOSS REDUCTION FOR HOUSING IN FLORIDA**

### **A RESEARCH PROJECT UNDERTAKEN BY THE INTERNATIONAL HURRICANE CENTER**

**At Florida International University**

## **QUARTERLY REPORT FOR THE PERIOD ENDED DECEMBER 31, 2001**

### **SUMMARY**

This report summarizes the activities of the International Hurricane Center (IHC), at Florida International University (FIU), and its research team related to the project designated as *Hurricane Loss Reduction for Housing in Florida* (hereinafter Project) being funded by the Florida Department of Community Affairs (DCA) under contract # 02-RC-11-13-00-05-001 executed on August 6, 2001.

This quarterly report covers activities of the IHC research team from October 1, 2001 through December 31, 2001. This quarterly report is submitted in compliance with Deliverable #4 of above referenced contract.

Ricardo A. Alvarez, Deputy Director at the IHC, is Principal Investigator (PI) and Project Director. Nicole Dash, Research Associate at the IHC, is responsible for project coordination.

Major activities during the period covered by this report include:

1. All contractual and administrative steps to organize and secure the research team for this project were completed.
2. October 15, 2001: First quarterly report, covering activities from August 7, 2001 through September 30, 2001 was completed and delivered to DCA on schedule.
3. December 5, 2001: Ricardo A. Alvarez, Project PI, and Richard Candia of FIU Government Relations, met with DCA Secretary Mr. Steve Seibert to discuss the Hurricane Loss Reduction Program, findings from research by the IHC during FY 2000, and the main objectives of the current research effort as well as ideas for

future efforts. Frank Koutnik and Leroy Thompson of DCA also attended this meeting.

4. December 7, 2001: Annual report of activities, summarizing activities from January 1, 2001 through June 30, 2001 that were pertinent to current project and containing a summary of activities from date of contract execution through the end of November, 2001, was completed and delivered as required by contract.
5. December 12, 2001: a working meeting of the IHC Project Team was held at the FIU Center for Engineering and Advanced Science.
6. Specifications and bills of materials for the testing equipment and related to the structural testing of various building assemblies were completed.
7. Process of bids/or quotation request to purchase these materials for testing was initiated.
8. Space requirements and electro/mechanical specifications to house various testing apparatus were prepared and submitted to FIU Department of Sponsored Research and also to FIU Academic Space and Facilities Management Directors for action.
9. Initial contacts for the purpose of securing the availability of airboats to provide wind loads for full scale testing of various roof assemblies were established. Both the South Florida Water Management District and various private parties have offered to make airboats available for such tests.
10. The week of December 17, 2001 a member of the team traveled to South Carolina to meet with Timothy Reinhold of Clemson University, also a research team member, for the purpose of observing field tests there and to discuss the protocols and scheduling of specific tests related to this project.

## **ORGANIZATIONAL/ADMINISTRATIVE ACTIVITIES**

During this quarter, the final research team was assembled at both the IHC and participating universities. The assembled research team is as follows:

<b>Principal Investigator:</b>	Ricardo Alvarez	FIU/IHC
<b>Project Manager:</b>	Nicole Dash	FIU/IHC

**Principal Researchers:**

Marshall Allen	FIU	HCET
Amaury Caballero	FIU	Construction Management
George Epolito	USF	Architecture
Trent Green	USF	Architecture
Martha Guterrez	FIU	High Performance Database Research Center
Jose Mitrani	FIU	Construction Management
Timothy Reinhold	Clemson	Civil Engineering
Stephen Schreiber	USF	Architecture
Cindy Zhang	FIU	HCET

**Research Assistants:**

Luis Arencibia	FIU	Construction Management
Elpidio Dominguez	FIU	Construction Management
Jorge Remedios	FIU	Construction Management

**Graduate Students:**

Deepu Bhattacharjee	USF	Architecture
Mike Dailey	USF	Architecture
Kurt Dyer	FIU	Construction Management
Janaina Monteiro	FIU	Construction Management
Mary Phillips	Clemson	Civil Engineering Graduate
Scott Robinett	Clemson	Civil Engineering Graduate
Roger Williams	FIU	Environmental Engineering

**Undergraduate Students:**

Brian Dick	Clemson	Civil Engineering
Cos Gardner	Clemson	Civil Engineering
Jon Lamb	Clemson	Civil Engineering

**Support Staff:**

Kyle Campbell	USF	Director of Florida Center
Maria Cano	FIU	IHC
Scott Caput	FIU	IHC

Regnier Jurado  
Jennifer Sanford

FIU  
USF

IHC  
Program assistant

## **ACTIVITIES BY RESEARCH TOPIC**

### **Eliminating State and Local Barriers to Upgrading Existing Mobile Homes and Communities**

The team from USF is working on two primary areas of investigation in phase II: ways to eliminate state, local barriers to upgrading existing mobile homes and communities; and research and development related to hurricane loss reduction devices and techniques for site built houses.

#### **I. Research activities**

- A. The team has begun developing GIS based maps for Polk County, using US census data, county land use maps, and state records
  1. The team has begun analyzing and redesigning site plans for existing mobile home parks.
  2. The team has begun an analysis of zoning codes, comprehensive plans, floodplain management plans, storm water management, and other local land use laws from west central region of Florida.
  3. Currently the team is analyzing codes in Polk County (in addition to the work already completed in Pinellas and Hillsborough Counties). The jurisdictions in Polk include: Auburndale, Bartow, Davenport, Dundee, Eagle Lakes, Fort Mead, Frostproof, Haines City, Highland Park, Hillcrest Heights, Lake Alfred, Lake Hamilton, Lake Wales, Lakeland, Mulberry, Polk City, Winter Haven, and unincorporated Polk County.
- B. Internet/literature search
  1. The team has conducted extensive Internet searches this quarter. Important information has been compiled on: codes in Polk County, state of mobile home parks in Polk County, existing hurricane resistant housing in the Southeast US and Caribbean regions, and historic information on the effects of storms on residences in west central Florida.

### C. Meetings

1. Representatives of the USF group have met with the IHC team and/or Deputy Director Ricardo Alvarez in October 2001 and December 2001.
2. The USF team has met internally once every two weeks during the quarter.

### D. Contacts/communications

1. Representatives of the USF group have met with officials from building and planning departments in major jurisdictions in Polk County, regarding issues of hurricane mitigation and residences.
2. The group has met with key mobile home park owners or managers in the study area.
3. The group has visited key mobile home parks in Polk County

## II. Research Details

- A. Eliminating state, local barriers to upgrading existing mobile homes and communities. Initial research from phase I of this project indicates that there are significant federal, state and local barriers to upgrading existing mobile homes and communities in Florida. Many of these barriers are unintentional put mobile home residents at risk. These barriers include knowledge gaps, and regulatory barriers. The USF research team is identifying and investigating these issues in land use regulations, community design guidelines, and building/zoning codes. The team will make recommendations on mechanisms to eliminate the most serious barriers. The work is focusing on the west central region of Florida.
- B. Research and development related to hurricane loss reduction devices and techniques for site built houses. The team is developing a “best practices” guide to the planning, siting, design, of residential communities in hurricane prone areas. The guide will address areas identified by this phase of research and through future investigations. In particular the “best practices” guidelines will emphasize: Site selection. This section would provide guidelines for selecting the most appropriate sites for residences in terms of hazard mitigation, land use compatibility and other issues.

### **III. Preliminary Findings**

- A. Issues of platting. Most mobile home parks in Florida were platted for travel trailers; or older, small singlewide mobile homes. Modern larger mobile homes, with safer design features, do not fit on the older plats. Therefore park owners are unable to accommodate new mobile homes and maintain required setbacks. The team is investigating several case studies of parks where these barriers exist, and propose solutions for replatting and/or modification of setbacks.
- B. Building code issues in zoning codes. The zoning codes for many jurisdictions include requirements that should be included in building codes (especially for tie downs, additions, etc.). Zoning officials, in many cases, do not have the expertise or training to enforce these requirements. This knowledge gap creates hazardous conditions. The team is identifying specific codes with these problems, identify similar citations in the new Florida building code, and recommend changes.
- C. Additions. The team is concerned about the significant number of poorly built additions to residences in the communities it visited. The site built additions are a significant cause of windborne debris in hurricanes. The team is investigating the role of zoning in this problem and will propose possible solutions.

### **Programs of Research and Development Relating to Hurricane Loss reduction Devices and Techniques for Site-built Residences**

#### **I. Research Activities:**

- A. Research activities completed during the quarter include the detailed design of the mobile vacuum test chamber for testing roof sheathing panels and the reaction frame for combined load testing of connections between the roof and wall structural systems. Plans were developed for a preliminary round of testing of roof panel connections to be conducted early in the next quarter and materials were ordered for these tests. Progress was made in identifying sources of air boats for the field testing of roof shingles on gable roof ends.

- B. A literature search was initiated to identify information concerning the treatment of combined loads on roof to wall connections. References were compiled on roof shingle testing standards and load modeling.
- C. Communication was established with Dr. Dan Dolan at Virginia Tech concerning load combination issues and their finite element modeling capabilities. It is anticipated that data obtained from the research on combined loads will be useful in improving their modeling capabilities.
- D. Preliminary tests of roof structures subjected to combined loads were carried out using one of the FEMA flood buyout homes in Horry County. Dr. Reinhold conducted the tests and Prof. Mitrani participated in witnessing and reviewing the tests. Dr. Reinhold and Prof. Mitrani were cited in the Wilmington, NC newspaper concerning the testing.

## **II. Research Details:**

- A. Design and construction of the test facilities are the most critical activities at the present because they will allow the timely completion of the testing and research to be completed in the 3<sup>rd</sup> and 4<sup>th</sup> quarters. Detailed design of the mobile vacuum chamber and reaction frame for the combined load testing have been completed. A detailed steel order has been prepared for the materials needed to construct these test apparatuses. In addition, orders for the supporting equipment for the vacuum chamber have been prepared. It is anticipated that these materials and equipment will be procured by the middle of January. The detailed design of the air-boat test facility is awaiting information on the size of air-boats that can be rented/borrowed. Potential sources of air-boats have been identified and details should be worked out early in the 3<sup>rd</sup> quarter. The next major push will be on the detailed design of the wind tunnel for testing of roof shingle products using Miami-Dade County protocols.
- B. Training of FIU students in the testing of roof panel connections is planned for the first week of January. Test materials have been procured and plans have been developed so that this training experience will also produce the first sets of test data. The test configurations planned include hand driven 8d common nails at 6-inch centers using both bright and galvanized nails. These correspond to baseline code provisions for South Florida (both *South*

*Florida Building Code* as well as the *Florida Building Code*). Additional series of panel tests include power driven 10d sinkers, power driven 8d ring-shank nails and cement coated 10d sinkers. Each series of tests will include 7 specimens and will be supplemented by individual nail pull-out testing from the same 2x4s used to construct the panel specimens. Additional sets of three specimens will be tested with missing fasteners in key locations and selected tests will be conducted with over driven power driven fasteners.

- C. The preliminary field testing of combined loads on a roof structure offered an opportunity for evaluation of the testing and system setup anticipated for the combined load test apparatus. Two cranes were used in the field tests. One crane applied a 3,000 pound lateral load to the roof of the structure while the second crane provided uplift loading until the roof separated from the wall. Two different roof to wall connection systems were used. The first was the as-built situation while the second involved retrofitting using H10 hurricane straps and full plywood sheathing of the walls.

### **III. Preliminary Findings**

- A. The preliminary field testing of the roof to wall connections subjected to combined shear and uplift of the as-built configuration exhibited about the same uplift capacity regardless of whether the lateral load was applied or not. It is important to note that the lateral load level tested was relatively low. It suggests, however, that the interaction diagrams may be such that for low design level loads, the reductions will be minimum. It may be that the largest interactions occur as the shear approaches the ultimate shear capacity. This type of interaction has been observed with the combined uplift and shear loading of roof panels.

## Research and Develop a Program for the Recycling of Existing Older Mobile Homes

### I. Research Activities:

- A. Identified construction materials and recyclable/reusable materials in mobile homes and the percentage of recyclable/reusable materials.

Materials in mobile homes that may be recycled or reused were identified through a visit to a mobile home demolition site, interviews with demolition contractors, and the report of a study on mobile home recycling conducted by the Vermont Agency of Natural Resources.

- B. Determined potential salvage value of the recyclable/reusable materials in mobile homes.

Salvage values of recyclable/reusable materials in mobile homes were determined through verbal quotes from five salvaging facilities in South Florida and interviews with mobile home demolition contractors.

- C. Identified contractors in the state that currently or could potentially carry out the removal and disassembly of mobile homes.

Online yellow pages were used to identify contractors in the state that currently or could potentially carry out the removal and disassembly of mobile homes.

- D. Located hauling companies in the state that could potentially transport mobile homes to off-site disassembly locations through online yellow pages.

Online yellow pages were used to identify trucking and heavy hauling companies in the state that currently or could potentially transport mobile homes to off-site disassembly locations.

- E. Began investigating the on-site and off-site demolition options by visiting mobile home parks and interviewing the park managers.

- F. Investigated permit requirements associated with mobile home demolition and waste disposal.

Permit requirements for mobile home removal and disposal may vary depending on the geographical location. Permit requirements in Miami-

Dade County were identified through interviews with officials at Miami-Dade County's Department of Environmental Resources Management (DERM), the Building Department, and the Department of Solid Waste Management.

## II. Research Details

- A. HCET has conducted extensive Internet and literature research to ascertain the involvement of other states in a similar recycling program. Although a mobile home recycling program is developing in a few states, our research suggested that only the State of Vermont has comprehensively documented their findings on a feasibility study of mobile home recycling. Though the scope of study in Vermont was much smaller than the one in Florida, the Vermont report provided plenty of useful information.

## III. Preliminary Research Findings

- A. Our research indicated that the market value for salvageable materials derived from deconstructed mobile homes is extremely low. As a matter of fact, the market value is at the lowest point in years according to the salvaging facilities we interviewed. The average quotes we obtained on clean metals and cables are summarized in the Table 1. The salvage values of other materials such as breaker boxes and bathroom fixtures are being investigated.

Table 1. Salvage Value of Metals

Salvageable Material	Scrap value/ lb (\$)
<i>Aluminum sheets</i>	0.36
<i>Extruded aluminum</i>	0.44
<i>Copper #1</i>	0.52
<i>Copper #2</i>	0.43
<i>Sheathed Copper wire</i>	0.17
<i>Brass</i>	0.50
<i>Cables</i>	0.05
<i>Galvanized steel</i>	0.10
<i>Tin</i>	0.0075

B. To facilitate presentation of the study findings, we have divided the state into seven (7) geographic regions as defined by the Florida Division of Emergency Management. The seven (7) regions are displayed in Figure 1.

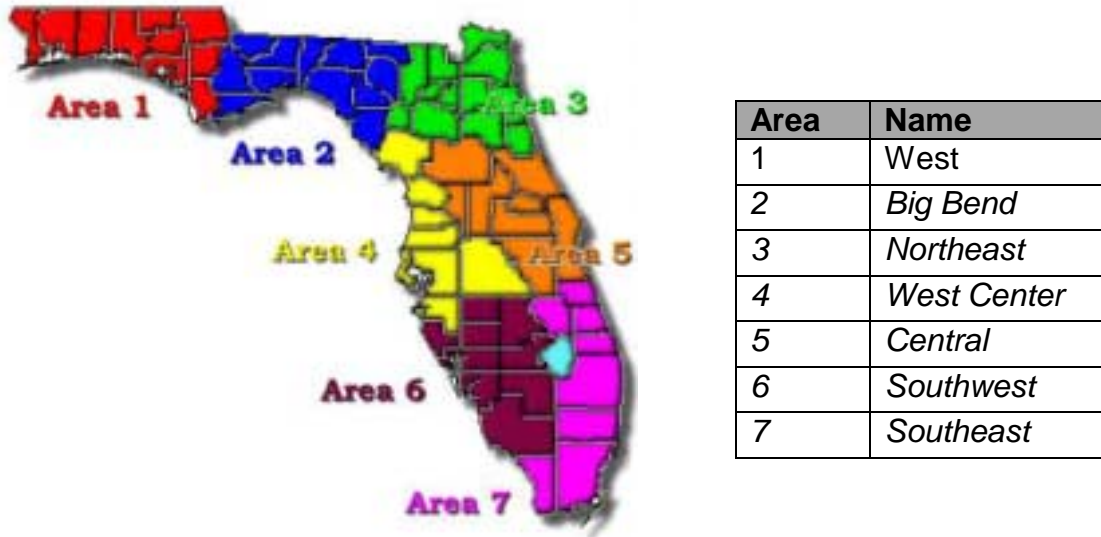


Figure 1. Florida Regions

C. Potential demolition contractors throughout the state have been identified. Table 2 shows the number of contractors in each geographic region. A few of these contractors were contacted to verify the range of services offered. Contractors contacted included R.M Equipment of Miami, Anu Way Contractors and Recycling of Miami, L&L Salvage Sales of Orlando, Disposal Depot Inc. of Tallahassee, and Goodings Goodies of Lake Worth and West Palm Beach. Quotations for mobile home demolition ranged from \$1,500 to \$6,000 depending on size, whether it is a single, double or triple wide and prevailing site conditions. It should be noted that ideally in areas where there is adequate work space, utility wires or poles absent with no neighboring settlements and if the clearance distance between the mobile home unit and Heavy Equipment (backhoe) is at least 16 feet, the price will be significantly reduced. Accessibility and workspace availability were determined to be the critical factors that dictated the cost of a project. Additionally, contractors such as R.M Equipment reiterated that if a project entails multiple units on the same park facility, a price of \$1000 dollars per unit could be negotiated. A telephone interview will be conducted to

determine a statewide average cost for demolition. Contractors in each of the seven regions will be contacted and their quotation on mass/multiple units will be addressed.

Table 2. Number of Potential Demolition Contractors in Florida

<b>REGION</b>	<b><i>Potential contractors</i></b>
West	10
<i>Big Bend</i>	6
<i>Northeast</i>	24
<i>West Center</i>	18
<i>Central</i>	34
<i>Southwest</i>	10
<i>Southeast</i>	63
<b>Statewide</b>	<b>165</b>

D. In considering the prospect of offsite demolition, a list of trucking and hauling companies was generated. These companies have the capacity to mount the entire mobile home unit on wheels, trolley or a flat bed and transport the trailers to a demolition or landfill site if the units are road worthy. Over 700 trucking and heavy hauling companies were identified in the state. These companies will be categorized based on their geological locations. A number of companies in each region will be contacted for quotation.