Proposals for Project to Florida Building Commission

20 June 2019

**DRAFT (Budgets are very Rough Estimates – requires analysis and approval first by UF)**

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To: Project Manager, Florida Building Commission

Project Proposal for Consideration by the Structural TAC and the Florida Building Commission - generated by the University of Florida. Items emanate from either existing project supports or generated through discussion with Staff of the FBC

1. **Vinyl Siding Project Phase II - $120k - $150k**

This is the second-phase of research commenced in the previous fiscal year to examine failure of vinyl siding and soffit systems observed following Hurricane Irma in 2017.

Phase I identified a number of vinyl siding products and documented their performance as well developed an augmented data set of wind speeds. Researchers also designed and fabricated an experimental test bed that will be used to simulate the air flow above and below an installed vinyl siding cladding in order to determine its Pressure Equalization Factor (PEF).

In the Phase II, we will conduct experimental studies using the vinyl siding pressure test rig preliminary tests to commission the new Test Bed and establish baseline tests on vinyl siding systems. Part of the commissioning will be to evaluate the wind resistance performance of a vinyl siding systems using the ASTM D5206 Test protocol for comparison.

Next, we will develop the experimental research plan for a parametric study to evaluate multiple wind loading configurations on the siding that models a sufficiently wide range of PEFs under spatially non-uniform pressures in order to determine an appropriate standard test approach. We anticipate using or conducting testing on 3 physical configurations of the test chamber with up to 5 pressure variations.

The goal will be to subject up two vinyl siding systems with known performance during recent hurricane to different wind pressure regimes to capture a reasonable replication of possible variability PEF values that occur under field conditions. We will report the results to the FBC recommending options for product approval testing for vinyl siding systems and similar air-permeable or discontinuous cladding materials.

1. **Code Plus Consideration for Florida – ~$80k**

The performance of buildings in hurricanes and tornadoes can be enhanced if they follow design and construction procedures that exceed the provisions in the current Florida Building Code. The public in many cases misunderstand that building code provisions represent a minimum standard and that they are at liberty to build to higher standards. Building to higher standards has benefits of reducing the vulnerability of a structure and potentially reducing or minimizing wind or storm surge damage. Research at state and federal levels has shown substantial benefits of strengthening houses; in one study for one dollar ($1) spent on structural retrofit a homeowner may benefit by the avoidance of up to $6 dollars in future storm damage.

This proposal reviews the prior Code Plus stipulations and guidelines that were used in Florida in or around 2007. The provisions were developed by Applied Research Associates, and IBHS and implemented by the Florida Building Commission.

* 1. In this scope of work, UF will review documentation on the previous Code Plus guidelines provided to us by the Florida Building Commission and available in the public domain.
  2. Review of the literature provided by FBC and others, including the 2007 Code Plus design (IBHS) and Legislature (if any)
  3. Develop updates of the ARA CodePlus models in the public domain that represents current state-of-the-art wind design provisions
  4. Identify and interviews with Codes Plus building contractors regarding the application of the building code provisions (specifically home builders)
     1. Include provisions for IRB survey protocol approval and survey design and implementation as necessary
     2. Assess the linkage between actual Codes Plus practice and construction costs (if this exists)
  5. UF will retain building code consultants (wind hazard and storm surge hazard) familiar with the Florida landscape to support the research effort and to comment on the provisions in relation to changes made to the Florida Building Code since 2007.
  6. Data MINING: UF will extract data from the data set of building observations made during Hurricanes Irma and Hurricane Michael studies and create a subset of structures built to Code Plus provisions.
     1. Extract information on code plus features that MAY be available within the building permitting records of the county appraiser
     2. Analyse the performance of the Code Plus houses against a group of similar houses that were subject to the same wind speeds.
     3. Summarize observations and lessons learned from Hurricane Michael pertinent to the whole state of Florida
  7. Develop and present recommendations to the FBC for a Codes Plus Provisions for Florida

1. **Modular Single-Family Homes - FBC - $20k**

From time to time during previous post-hurricane studies the researchers encountered structures defined as modular homes - which are manufactured off-site and transported to its final location. These structures fall within the jurisdiction of the FBC.

This study seeks to determine the relative performance of modular homes versus other site-built constructed single-family houses during recent hurricanes. UF proposes the following scope:

* 1. Research key identifiers for modular homes from FBC regulations. Identify the identification plates and serial numbers if any.
  2. Extract from the existing UF data set of structures observed during the post-hurricane damage observations all and any modular homes.
  3. Document the wind speeds, orientation of structures and extent of damage occurring.
  4. Develop additional metadata such as permitting and structural plans, manufacturer and date of installation of the modular houses using publicly available Building Appraisers Website.
  5. Obtain structural plans from the FBC using identifier information on the houses
  6. Report on the relative performance and structural details of modular houses versus site-built houses during the recent Hurricanes Irma (2017) and Michael (2018)

1. **Fenestration Testing Follow-on ($180k - $250k)**

In order to study the issues of water intrusion through building envelope systems during hurricanes, UF proposes to develop and conduct tests on mock-ups of full-scale building envelope systems. The scope of the work is as follows

* 1. Identify common building envelope systems (stucco, EIFS curtainwall, brick) that are used in high-rise Florida construction by interviewing building officials in Metro-Dade, and Tampa, and Orlando areas.
  2. Contact product approval testing agencies to Identify any current Florida projects under construction that are undertaking wind driven rain tests
  3. Negotiate to use Full-scale mockup tests after testing is complete at the approval facility and conduct tests at 25%, 50%, 75% and 100% of structural design pressure
     1. Use fluorescent dyes in water and identify the time and location, and total quantity of water infiltration.
     2. Report on
  4. If current building do not meet criteria, conduct on-site tests on an existing building (Optional: ADD $50-75k)
  5. Provide results and to FPHLM for model recalibration (Pinelli $25k)

1. **Hurricane Michael Data Enhancement. (Phase II) ($56k)**

The data enhancement of the Hurricane Michael deployment database has provided several useful outcomes for the FBC. It has been used to compare performance of pre and post FBC code provisions. It is being used to estimate the interior damage of houses of a particular age and construction. However, the effort is time-consuming and only 33% of the data enhancement has been completed.

This scope proposes to continue the work presented in a final report on 18 June 2019 to the FBC meeting in Sarasota and to continue the Data Enhancement and database augmentation for about another 400 to 450 houses over the next fiscal year.

The rationale for this work is the procedures are now in place to conduct this work and the two universities have students who are trained so that this will be an opportune time to accelerate the augmentation. Ultimately this phase will yield approximately 600 data sets that are augmented and categorized for the construction affected by Hurricane Michael which can used to support any questions received from the Legislature on the performance of single-family Florida Houses

1. **Research outcomes from FEMA’s MAT reports**
2. **Wireless Sensor for measuring Wind Pressure on Actual Structures**