

**POST
HURRICANE WILMA
PROGRESS ASSESSMENT**



**BUILDING CODE COMPLIANCE
OFFICE**

April 2006

INDEX

Background	1
Preliminary Assessments	2
Structural Damage	3
Roof Tile Damage	3
Shingle Roof Damage	5
General Roof Damage	7
Wood Fences	8
Screen Enclosures	9
Glass and Glazing	9
Mobile Homes	12
Building Construction Successes	12
Post Hurricane Proactive Responses	12
Daily Damage Reports	13
Existing Challenges	14
Unrepaired Structures	14
Out of State Contractors	15
Plywood Covering Damaged Opening	16
Unlicensed Contractor Activity	17
Building Code Modifications	18
Summary	19

BACKGROUND

Hurricanes Katrina and Wilma represented the greatest test, to date, of the enhanced South Florida Building Code with its hurricane mitigation provisions that was implemented in September of 1994. The 1994 code was designed to address the weaknesses associated with the building envelope that became evident with the destruction caused by Hurricane Andrew. Analysis of Hurricane Andrew damage identified three main areas of building construction weakness: roof systems, opening protection and roof sheathing attachment. Over the years the South Florida Building Code was modified on several occasions. Ultimately, in 2002 the improved structural portions of the South Florida Building Code were adsorbed into the Florida Building Code as the High Velocity Hurricane Zone provisions, which are applicable within Miami-Dade and Broward Counties.

It was not until the storms of 2005 that the improved structural building envelope provisions of the building code were put to the test in actual conditions. The Building Code Compliance Office views the 2005 storms with a certain level of ambivalence. On the one hand the destructive property loss and the ensuing economic hardships placed on the community are regrettable. However, the storms offered an opportunity to observe and assess the performance of building envelope systems and components in “real world” conditions. Though at most, the storms produced Category 2 winds, it is important to note that this is sufficient to obtain valuable and usable data that in many instances is far superior to that which may be obtained through laboratory testing.

So it was with great interest that the Building Code Compliance Office’s technical staff responded to the field in the aftermath of Hurricanes Katrina and Wilma to conduct assessments and to begin to provide guidance and assistance to the various municipalities. The Office staff divided the County into sections with staff assigned to a particular geographical area. By the end of the day following Hurricane Wilma, the buildings south of Kendal Drive had been assessed. By the end of the next day initial observations throughout the Incorporated and Unincorporated areas had been made.

Above all, the requirement that all structures must have windborne debris protection represents the greatest success story regarding damage mitigation. This requirement was implemented with the 1994 South Florida Building Code and was carried forward into the High Velocity Hurricane Zone section of the Florida Building Code. The citizens of Miami-Dade County clearly understand the benefits offered by the installation of impact shutters. As a result, the public responded to the hurricane warning, en masse, by taking the necessary steps to protect their homes. The public is well educated regarding the catastrophic affects hurricanes can produce. The concept expressed by some opponents to wind borne debris protection is that homeowners will not install shutters, even if

the code requires that they be provided, was not borne out. Importantly, evidence of significant complacency and indifference was not observed.



View of well prepared home which suffered no hurricane damage.

Across Miami-Dade County, Hurricane Wilma produced widespread, but for the most part, minor damage. Much of damage observed would be consistent with a Category 1 or minimal Category 2 event. A summary of the damage observed is provided below:

PRELIMINARY ASSESSMENTS

- ✚ Structural Building Components damage, insignificant to none.
- ✚ Roof tile damage, hip and ridge and first course damage.
- ✚ Shingle roof damage, shingle loss isolated, predominately, to older roofs.
- ✚ Roof damage in general, losses appeared to be installation deficiencies.
- ✚ Damage to wood fences.
- ✚ Damage to screen enclosures.
- ✚ Glass and Glazing damage, primarily in high rise buildings.
- ✚ Mobile home damage.

STRUCTURAL DAMAGE

Main wind force resistance systems of structures were, for the most part, unaffected by the high winds, with minimal damage being observed. Only those obsolescent and un-maintained buildings suffered structural damage and only in isolated instances.

As can be expected, the weakness of older structures and those with poor workmanship were exposed. Construction, alterations, additions and repairs built under the post-1994 South Florida Building Code and the Florida Building Code fared very well.

Enhanced attachment of roof sheathing coupled with a mandatory sheathing inspection which was implemented in 1994 was clearly demonstrated to be a success. With the implementation of the 2004 edition of the Florida Building Code further enhancements regarding sheathing fasteners took place. New installations of wood sheathing now require the use of ring shank fasteners. With minimal impact to cost, the attachment of sheathing now can be relied on to perform under high uplift pressures.

Strengthening of the Code in 1994 regarding gable end construction and roof truss bracing resulted in no structural damage to those elements. Since 1994 the code has eliminated composite gable end construction and required the installation of truss bracing, with accompanying inspections by local building departments.

Finally, garage doors and exterior doors did not appear to suffer significant damage.

ROOF TILE DAMAGE

The hip and ridge caps on both concrete and clay roof tile installations suffered wind loss damage. Hip and ridge caps installed with mortar performed poorly with clay tile being the most affected. Hip and ridge caps installed using one of the five enhanced methods prescribed in the code for mechanically attached tile performed very well except in cases where lack of adequate workmanship was evident. In these cases, observations were made of metal channel/adhesive configurations where the foam did not rise to make contact with the hip and ridge tile component. It seems that either channels not match to the tile configuration were used or the adhesive did not rise sufficiently to make contact. Ultimately, in both cases the hip and ridge tiles were not secured to the roof, with only the cosmetic closure mortar offering any adhesion.



Typical view of hip cap wind loss on a clay tile system.

Mechanically attached tile roof systems suffered the loss of the first course of tile, in many cases. This phenomenon was not observed in either mortar set or adhesive set tile installations. In some cases the lifting of the first course of tile resulted in progressive but diminishing loss of roof tile in the second and third courses. The first course of tile is installed with a typical two inch overhang beyond the eave of the roof. This seems to expose the first course of tile to greater wind induced uplift. With the tile fastener near the top edge of the roof tile, the wind was observed, to rotate the lower edge of the tile upward. Once lifted the tile becomes increasing vulnerable to wind loss, with the possibility of large missile debris being generated.



Typical view of first tile course wind loss.

SHINGLE ROOF DAMAGE

The effects of hurricane force winds were most evident and widespread with regard to asphalt shingle installations. Nonetheless, there was a clear and direct correlation to the age of the shingles and the amount of damage sustained. Shingle roof systems five years and less in age encountered little to no damage, while shingle roof systems dating from post hurricane Andrew or older saw, in some cases, significant shingle tab losses. Loss of entire shingles was more the exception than the rule. Discussions with shingle manufacturers reveal that the shingle tab sealant, used to seal down the shingle tabs, has been modified in recent years to create a more rigid seal that will also allow for thermal movement of the shingles. It was observed that the level of wind encountered did not cause shingle fastener pullout or shingle pullover except in isolated instances, even though shingle tab adhesion failed. The code since 1994 regarding shingle attachment stipulates a minimum of six ring shank roofing nails per shingle. With the underlayment and significant portions of the roof shingles remaining in place, coupled with the onset of, post hurricane, drier weather conditions, resulting water intrusion damage remains minimal. As the rainy season approaches, those unrepaired roofs may begin to experience water intrusion problems.



Side by side view, undamaged new shingle on the left. Damaged older shingle roof on the right.

Enhanced underlayment attachment for steep roofing systems was implemented in 1994. It was contemplated that if damage to the prepared roof covering occurred the underlayment would stay in place to provide redundancy in minimizing water intrusion damage, with a resultant overall mitigation of property loss. This concept proved to be a success. Where shingle losses occurred, the underlayment remained in place contributing to the water shedding capabilities of the roof system. Dozens of buildings, either being constructed or in the process of being reroofed were assessed; these buildings were at the dry-in stage with only the underlayment and edge metal installed. It was observed that the benefit achieved as a result of this requirement clearly reinforced the value of enhanced underlayment attachment.



View of roof with shingle loss, with underlayment still in place.

GENERAL ROOF DAMAGE

Soffits in residential building did not suffer wind loss or water intrusion with resultant interior damage that was observed in areas of the state impacted by Hurricane Charley, Frances, Irene, and Jeanne.

Commercial/industrial roof systems installed according to the code performed very well. The exception is the performance of fully adhered recovers. Mechanically attached recovers were not observed to have suffered damage significant wind loss damage.

The fully adhered recovers involved recovers installed over existing gravel roof systems with an insulation board installed over the gravel and secured in a flood coat of hot asphalt. The surface of the insulation is then used as the substrate for the recover roof system. In many cases it was observed that loss of adhesion occurred or lack of positive woodblocking attachment allowed for the wind to peel the roof system when the woodblocking failed.

WOOD FENCES

Poorly maintained and obsolescent wood fences were observed to be the most vulnerable to wind loss damage.



View of wood fence damage caused by obsolescence.

SCREEN ENCLOSURES

Impact of debris and installation deficiencies was observed to be the primary cause of damage.



View of screen enclosure damage caused when screen panels did not break away.

GLASS AND GLAZING

High rise buildings in isolated areas of the county were affected. Loss of glazing in balcony railings, sliding glass doors, curtain walls and windows did occur. However, none of the damage was observed in buildings constructed under the most recent building code. In those isolated cases where the building envelope was breached, interior damage due to water intrusion and internal pressurization occurred, causing collateral damage. Glazing above 30' is currently required to meet the small missile impact test consisting of 2 gram steel balls projected at a test sample in groups of ten at a velocity of 130' per second.



View of large missile debris impact above the 30th floor.

Many of the structures which sustained broken glass were constructed prior to any impact test requirements, while others were constructed under less stringent small missile impact tests. Only the capricious nature of wind within a hurricane can serve to explain why so many areas of the county did not suffer glass and glazing loss even though the buildings contained the same type of glass as those buildings which did suffer losses. It is clear that within a hurricane there are streams of wind moving at velocities that far exceed the overall category of the storm.

Glazing damage in the Brickell area was primarily limited to four buildings. However, and surprisingly, many nearby high rise buildings suffered little or no glazing damage. There seemed to be a channeling effect of the wind which created an isolated path of damage.

The City of Aventura saw damage primarily in buildings which predated the 1994 South Florida Building Code. Modes of failure were observed to be caused by flying debris. Gravel from adjacent roofs, furniture, planters and other items left on high rise balconies and wind induced pressurization.

Miami Beach experienced little glazing damage but did see damage to high rise glazed balcony railing systems.



View of damaged buildings in the Brickell area.



View of glazing damage in the Brickell area.

MOBILE HOMES

Mobile homes are considered vehicles and are regulated by the Department of Transportation and Motor Vehicles. Nonetheless, they are used as primary residences for many members of the community. Obsolescence, lack of maintenance and attachment of unauthorized additions all contributed to the observed damages.

BUILDING CONSTRUCTION SUCCESSES

In conducting assessments it is easy to focus on the damages and failures, but it may be more important to note the successes. The following is a brief summary of building construction systems and components that did perform as intended, thereby serving to provide protection to the public while minimizing property loss.

- ✚ Steel, concrete, masonry and wood frame structures.
- ✚ Precast concrete panels.
- ✚ Sheathing attachment.
- ✚ Gable end construction
- ✚ Window, curtain wall and sliding glass door frames.
- ✚ Glass tested under the current impact tests.
- ✚ Exterior and garage doors.
- ✚ Impact protection devices.
- ✚ Metal roof systems and commercial roof systems.
- ✚ New shingle roofs.
- ✚ Field tile attachment.
- ✚ Enhanced fastening of steep slope redundant water shedding systems.
- ✚ Anchorage of mobile homes.

Following the preliminary countywide assessments, the focus of BCCO shifted to providing specific assistance to all municipalities. Some of those responses are shown below.

POST HURRICANE PROACTIVE RESPONSE

- ✚ Elicited daily damage reports from each municipality.
- ✚ Direct assistance to the City of Miami regarding glazing issues.
- ✚ Direct assistance to the Town of Medley regarding damaged mobile homes.
- ✚ Direct assistance to the City of Sunny Isles Beach regarding high rise repairs.
- ✚ Expedited the approval process of products needed for hurricane repair.
- ✚ Provided Staffing to the Emergency Operations Center.

- ✚ Prepared and conducted a damage assessment report for the Florida Building Commission.
- ✚ Submitted Florida Building Code modifications.
- ✚ Distributed “What to Know when Hiring a Contractor” brochure to homeowners in affected areas.
- ✚ Initiated the establishment of a joint agency task force to curtail unlicensed contractor activity.
- ✚ Numerous workshops conducted.

DAILY DAMAGE REPORTS

Lines of communication were established with each municipality. Damage reports were collected at BCCO and information regarding unsafe structures were tabulated and reported to the appropriate local, state and federal agencies. These reports offered a current view of the number of unsafe structures within the county and, to a certain extent, the number of persons displaced. The data collected also provided a clear indication as to where BCCO efforts would best be directed.

CITY OF MIAMI

BCCO staff responded to the City of Miami in an effort to provide technical support to the Building Official with regard to the damaged glazing in the Brickell area.

Staff conducted a series of on site inspections of the buildings involved. The purpose of the inspections was to attempt to determine the extent of the damage and what impact that damage would have on the occupancy of the building. A secondary purpose was to determine the cause of the damage in order to establish if the building code contained any weaknesses that would require correction BCCO staff immediately provided necessary guidance regarding the measures required to make the damaged buildings safe for at least partial occupancy, in the shortest time. In the case of the Espirito Santo building was given partial occupancy within a week after the storm.

TOWN OF MEDLEY

Assisted the Building Official with assessments of a trailer park within the municipality. On site inspections were conducted in the company of the Mayor, the Building Official, City Commissioner and police department. Complete damage assessments were made and determination regarding unsafe structures were arrived at.

SUNNY ISLES BEACH

BCCO actively participated in meetings with the Building Official, repair contractors and consulting engineers in order to establish the correct course of action to facilitate building repairs.

EXISTING CHALLENGES

- ✚ Unrepaired Structures.
 - Labor Force
 - Insurance disputes
 - Material shortages and non-approved materials
 - Building Inspectors
- ✚ Plywood used to temporarily close damaged window openings
- ✚ Unlicensed Activity

So many of the hurricane related challenges that face the community, today, go beyond local government's ability to directly intervene. Nonetheless, it is reasonable that each of these challenges could be anticipated and mitigation efforts employed.

UNREPAIRED STRUCTURES

It is evident that a percentage of hurricane repairs will not be made before the start of the 2006 hurricane season. However, this is consistent with our experience after the Category 5, Hurricane Andrew. Though Hurricane Wilma was not as strong as Hurricane Andrew, Hurricane Wilma affected the entire county causing widespread damage in every municipality. Nonetheless, record numbers of permits are being obtained and repairs are moving forward with predictable and isolated delays. Factors which are affecting the pace of repairs include, labor shortages, insurance disputes and material shortages coupled with the large number of buildings which require repair. Additionally, large numbers of inspection requests have been generated, taxing the capabilities of the municipal building departments to quickly respond. Understandably, material shortages have been primarily affecting roof repairs and glazing repairs.

ACTIONS TAKEN

In order to facilitate roof repairs the Governor has ordered that licensed Certified General, Building and Residential Contractors may perform hurricane related repairs and replacements of asphalt and fiberglass shingles. In doing so, the pool of contractors available to assist the community with hurricane repairs is broadened considerably. Ordinarily these contractors cannot pull roofing permits. As a result, BCCO releases "contractor holds" in order to facilitate the issuance of permits to the State Certified Contractors. Additionally, BCCO worked through the Florida Roofing and Sheet Metal Association to encourage out of area State

Certified Roofing Contractors to participate in the hurricane related roofing repairs within the County, as well as, enlisting the aid of roofing contractors for the No Blue Roof program. BCCO has provided workshops for the non-local contractors in order to ensure that they are made aware of the proper procedures for filling out roofing permit applications and the enhanced shingle installation requirements within the High Velocity Hurricane Zone.

Measures were taken by BCCO to expedite the approval of hurricane related materials and to approve additional manufacturing plants. Personnel were allocated and applications were quickly routed through the approval process. As repairs are completed the demand for repair materials will plateau and then begin to decline.

BCCO conducted ongoing meetings with the insurance industry in an effort to ensure that the unique building code requirements of the High Velocity Hurricane Zone were properly understood. In this way Adjustors could make informed decisions regarding allocations for repairs. Additionally, BCCO spearheaded an initiative with Florida Department of Financial Services in order to establish repair pricing guidelines for the insurance industry. These guidelines were designed to reflect the additional costs associated with hurricane repairs in the High Velocity Hurricane Zone and to provide useable data for repair disputes brought to arbitration. Through these efforts local government has acted to reduce the backlog of buildings which are still seeking settlement with their Insurers.

The Unincorporated Miami-Dade Building Department has taken steps to provide responsive building inspections six days a week. Other municipalities have followed this lead. Building inspectors with necessary qualifications have been dual certified as residential roofing inspectors in order to lessen the burden placed on the Roofing Section. Additionally, the Building Department's premiere E-Permitting system has proven to be an extremely valuable tool in expediting the issuance of repair permits. Finally, local legislation is being pursued which would create a new category of inspector, specifically for residential buildings. The efforts of the Building Department to streamline the permitting and inspection process coupled with cutting edge automation have created an environment of cooperation and efficiency.

OUT OF STATE CONTRACTORS

The Governor has indicated that out of State contractors may be utilized at the discretion of the local governments within Florida. The concept is to bring as many contractors as possible to affect repairs in the shortest possible time frame. Palm Beach, Broward and Miami-Dade Counties determined that this option would not be in the best interests of the community. While this is an attractive short term solution, experience has shown that when contractors from outside Florida are employed, the incidence of fraud increases, permits are not pulled, inspections are not performed, jobs are left unfinished, warranties cannot be

enforced and call back repairs will not be honored. Additionally, out of state contractors often bring their own materials which are not up to the high standards necessary to comply with the local building code.

Finally, there is no regulatory arm which will reach a contractor who resides outside the state of Florida. Ultimately, the out of state contractor option does not afford the necessary protection for the citizens of the county.

Clearly, as repairs are completed the inventory of damaged buildings is correspondingly reduced. The result is less demand for materials, contractors and construction technicians and laborers. As history has shown, some buildings will not be repaired, for various reasons. These buildings will be addressed by the local Building Official as “unsafe structures”, and compliance will be achieved through this mechanism.

PLYWOOD COVERING DAMAGED OPENINGS

While most municipalities had moved forward with repairs of broken glazing, the City of Sunny Isles Beach sought clarification from the Miami-Dade County Board of Rules and Appeals and is now moving forward with repairs.

The Board of Rules and Appeals for both Miami-Dade and Broward Counties issued an interpretation regarding the repair of glass and glazing and the repair of glazed balcony railing systems. The interpretation of the Boards offers guidance with regard to the repair requirements contained in the Florida Existing Building Code. The Florida Existing Building Code allows for repair of broken glass, in many cases, with the same glass that met the building code when the building was constructed. However, if the frame of the glazed window or door also sustained damage, the Florida Existing Building Code requires that the window or door be replaced with an assembly which meets the current building code. The Boards also stipulated that balcony railing systems are in a hazardous location and must be repaired to meet the current building code requirements.

Currently delays are being experienced in acquiring replacement glazing for high rise repairs. In most cases special order replacement glass is necessary, in order to match existing tints and styles. In the mean time, plywood has been installed where the glazing has been broken in order that the buildings may be safely occupied. For the most part permits have been issued and repairs are proceeding as the glass becomes available.

In the event of a severe storm warning the Building Official will order these buildings evacuated. Most of the buildings are already in an evacuation zone in the event of a hurricane warning.

UNLICENSED CONTRACTOR ACTIVITY

The large inventory of buildings which need repair is a lure to unscrupulous and unlicensed contractors who follow disasters for the purpose of preying upon a community eager to rebuild. Additionally, the local labor workforce is also tempted to strike out on their own to illegally contract construction repair work.



Unlicensed contractor being taken into custody.

ACTIONS TAKEN

- ✚ Distributed brochures to owners regarding contractor hiring practices.
- ✚ Initiated a joint task force of state and local agencies to proactively curtail unlicensed activity.
- ✚ Increased the number of Commercial Checkpoints.
- ✚ In a joint effort with the MDPD conducted a unlicensed contractor sting operation.
- ✚ Conducted county line commercial checkpoints with Broward County Officials to curtail movement of unlicensed contractors from county to county.
- ✚ Use television and print media to publicize unlicensed contractor efforts as a means of deterrence.



BCCO staff checking for contractor licenses at a Commercial Checkpoint.

BUILDING CODE MODIFICATIONS

The empirical evidence regarding the weakness of mortar set hip and ridge attachment and the loss of the first course of tile on mechanically attached tile systems provided clear evidence that remedial action was necessary. Hurricane Wilma occurred while the Florida Building Code was in a code modification cycle. As a result, BCCO submitted code modifications which would eliminate the mortar set option for hip and ridge tile. Additionally, a code modification was submitted to require specific post installation testing of hip and ridge cap installation by third party testing agencies. The issue regarding the loss of the first course of tile was also addressed with a code modification which would require that a tile clip be installed along with the other required tile fasteners on each tile along the first course for mechanically attached roof tile systems.

Each of these code modifications are moving through the Florida Building Commission process and are on a consent agenda for the May 1-4, 2006 Commission Meeting. If approved these code modifications are tentatively scheduled to implement on November 1, 2006.

Other apparent weaknesses were observed during the post Hurricane Wilma assessments such as:

- ✚ Large missile impact debris above 30'.
- ✚ Gravel from adjacent roofs causing impact damage.
- ✚ Fully adhered roof system recovers over existing gravel roof systems.
- ✚ Impact damage to glazed balcony railing systems.

The triennial 2007 Florida Building Code Modification Cycle is now underway. These issues will be the focus for code modifications during this cycle. Input from industry, Broward County and other stakeholder groups will be sought and discussions will be held. The deadline for submission of code changes during this cycle is September 1, 2006.

SUMMARY

Post hurricane repair work seems to follow a standard sequence with insurance companies mobilizing their adjustors, conducting assessments, and offering settlements. Each of these initial phases can bog down, whether it is because of not enough Adjustors to meet the demand or unreasonable settlement offers. In some case mediation or arbitration is necessary to finally resolve the insurance settlement. Only then is it possible for most owners to move forward with repairs.

The repair stage has its own set of challenges with finding qualified contractors, signing contracts, acquiring permits and scheduling repair work. Issues of timely inspections are also a consideration. Again there are expected delays with each of these stages leading up to the commencement and execution of repairs.

Repair work around the State, in response to the 2004 hurricane season, is still being performed. It will be years before the Gulf Coast States are fully repaired and rebuilt.

It has only been six months since Hurricane Wilma occurred. Even though repairs are rapidly moving forward it is not reasonable to expect that they will be completed by June 1, 2006.

As public servants the County has done much to ensure the durability of building and structures by embracing a strong building code and putting in place regulatory oversight to ensure the uniform application of that code. The creation of the 311 Call Center has provided a centralized means for obtaining hurricane and building repair information. For their part, the community has recognized their obligation to assist with damage mitigation by taking the necessary steps to secure their homes. Clearly, they recognize that for those not in an evacuation zone their home will be their hurricane shelter.

Fortunately, Miami-Dade County has learned the lessons of history with regard to hurricanes. Measures implemented that have strengthened the building have proven, in most cases, to have prevented losses. The enhanced fastening of roof sheathing, the bracing of trusses, the elimination of composite gable ends, the improvements in masonry construction, the testing requirements and approval of exterior doors, garage doors and windows and the countywide requirement for impact shutters are just some of the building code enhancements unique to South Florida which have proven their worth. Without question Miami-Dade County has been and continues to be on the front line of hurricane mitigation efforts.