



Photos courtesy of the Florida Department of Community Affairs.

## High-Rise Windows that Failed

by Dave Olmstead



**H**urricane Wilma, which caused an estimated \$10 billion in damages in October 2005, was unique for many reasons. The 21st storm of the 2005 season was the worst Atlantic storm on record; Florida Power & Light (FPL) reported that it impacted more of its 4.3 million customers than any other storm, and then there were the dramatic images of destroyed high-rise buildings on Brickell Avenue in Miami, downtown Fort Lauderdale, and West Palm Beach.

Broward County school district's 14-story headquarters—known as the Crystal Palace—was stripped of nearly its entire glass facade on one side; luxury, high-rise condos in Miami and Fort Lauderdale that appeared to be newly built lost hundreds of windows.

Immediately following the storm, there was wide-spread speculation as to why so many high-rise windows failed. Media attention was largely due to the extent of the damage and the prestige of some of the buildings that suffered damage. Additionally, because buildings like the Four Seasons on Miami's Brickell Avenue received their Certificate of Occupancy's relatively recently, the media and consumers assumed the buildings were built to the most current building codes. It's a little known fact that the Four Seasons was permitted in 1984 even though the CO was issued in 2004.

It is important for the public to know the truth of why high-rise windows failed during Hurricane Wilma so that they can make educated decisions on home hurricane protection.

### **The Facts Behind the Devastation**

A report issued by the Miami-Dade Product Control and the Palm Beach Building Department on the cause of high-rise window failure during Hurricane Wilma concludes that impact-resistant laminated glass windows in high-rise buildings throughout South Florida performed very well during Hurricane Wilma, and the window failures that received wide-spread media attention were in buildings with tempered glass. The report was presented in December to the Florida Building Commission's Hurricane Research Advisory Committee and the Florida Building Commission.

According to the report, there were no reported failures of impact-resistant (laminated) windows in any of the areas affected by the hurricane. The presentations included dates buildings were constructed, samples of the glass that failed, and topographical and aerial views. Based on the findings, the Commission felt the current codes related to this issue were adequate and no further action was taken.

### **Tempered Glass vs. Impact-Resistant Laminated Glass**

Tempered glass may be four times stronger than regular glass, but experience taught code officials it is not strong enough for a powerful hurricane or the wind-borne debris carried by the storms. As a result, Miami-Dade, which currently enforces the strictest protocols for wind-borne debris in the country, made changes to Small Missile Testing for opening protection in high-rise buildings in 1994. The new codes went into effect in 1998. As of 1998, a product is declared small-missile resistant after it has been exposed to various impacts with 10 ball bearings traveling at a speed of 80 feet per second. The product is then subjected to hurricane loading ranging from 1,342 to 9,000 wind cycles. Prior to this code change, gravel, which is lighter and softer than a steel ball bearing, was used in the

test. The windows are tested not only to resist impacts, but also to continue to protect the opening even if severely impacted early in the storm. They also provide weather protection and security against smash and grab looting after the event.

Impact-resistant laminated glass is constructed by bonding a tough polyvinylbutyral plastic interlayer between two pieces of glass under heat and pressure. Once sealed, the glass "sandwich" behaves as a single unit and appears transparent, just like ordinary glass. A special silicone glazing process helps keep the glass from breaking away from the frame. The product must have been tested as a complete unit to the building code requirements in order to be code compliant.

A step toward consumers making educated decisions about home hurricane protection is to determine what type of glass they have in their home. Impact-resistant windows will have a label that states that the windows have been tested to TAS 201 and TAS 203 (PA 201 and PA 203, for older homes) or ASTM E1886 and E1996. The label is usually on the frame at the upper left side of the product.

If they determine that they have tempered glass they may want to consider various types of code-approved protection. Options include shutters and impact-resistant windows and doors, and in some areas, plywood may be used. However, often in high-rise buildings, with no way to fasten the protection, shutters or plywood are not viable options. Additionally, in Florida where many condominiums are part-time or seasonal residences, homeowners are not present to install the shutters or plywood. As a result, units are left unprotected, opening them up to a total loss of their home and contents. It also puts their neighbors at risk for both water intrusion and wind-damage, which can have a domino effect in multi-story buildings.

As South Floridians continue to recover from two record-breaking hurricane seasons and prepare for the 2006 season, it is imperative that they are armed with the facts. Home hurricane protection cannot only mitigate billions of dollars in insured and uninsured damages, but can also help to prevent tragic loss of life and injuries.

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