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# The Impact of Impact-Resistant Windows



Major code changes have been enacted in recent years in response to hurricane damage requiring building envelopes to be more weatherproof and impact resistant. In fact, the damaging effects of gusting winds and windborne debris have been so widely documented that the entire Atlantic Coast has been declared a hurricane-prone region.

In the aftermath of Hurricane Andrew in 1992, South Florida adopted the first hurricane-resistant building codes and standards. What is less known is that the first code was actually based upon lessons learned from Cyclone Tracy, which hit Darwin, Australia, in 1974.

Engineering studies following the Darwin devastation found that the vast majority of the damage was caused by windborne debris and fluctuating pressures. Experts concluded that the single-gust concept of design was inadequate to protect against sustained, turbulent winds that change direction slowly and carry debris.

## Lessons Learned: The Code Works

Yes, impact-resistant window systems work; however, the codes mandating such systems also aid with insurance and sales issues (thanks to Hurricane Wilma).

In 2005, Hurricane Wilma damaged many South Florida buildings built before impact-resistant codes (to the cost of \$20.6 billion). While insurance claims are *still* pending for pre-code buildings, others built with the new code suffered little.

With clear evidence of the code's success, Florida recently passed a statute requiring any condominium greater than 3 stories tall be inspected every 5 years to provide a report under seal of an architect or engineer.

The benefit? In case of storm damage, you'll have a certified report stating that your facility was maintained to code, which should expedite insurance claim payments. Also, the report could be used in the sales process to erase doubts about the building's health or pending audits for maintenance. With little surprise to the buyer, the sales process could also be expedited in a tough market. Other coastal states may follow suit on this statute.

Based upon these findings, new codes and test methods were developed with the intention of reducing the damage caused by hurricane winds and flying debris. The original test standards or protocols, *TAS 201*, *202*, and *203*, were developed by the state of Florida. Subsequently, ASTM developed two standards, *E1886* and *E1996*, which have been adopted by the American Society of Civil Engineers (ASCE) and the Intl. Building Code (IBC).

*ASCE 7* defines hurricane-prone regions and windborne-debris regions. Only buildings constructed in designated windborne-debris regions are required to have impact-resistant glazing to prevent wind from entering the structure (termed "internal pressurization") or be designed to withstand increased loads resulting from internal pressurization. And, the code has been proven to work (see *Lessons Learned: The Code Works*, on the right).

For a glazing product to qualify as impact resistant, it must be demonstrated through testing that the assembled system meets the requirements of the standards:

1. Impact with projectiles representing windborne debris – either large missile (projectile is a 9-pound, 2x4 timber) for systems in the lower 30 feet of a building, or small missile (projectiles are 10 2-gram steel balls) for systems 30 feet and above.
2. Followed by cyclic structural loading (9,000 positive and negative static pressure loads) representing fluctuating wind pressures.

Products are qualified based upon the ability of three test specimens to resist large- or small-missile impacts, or both, without penetrating the inner plane of the glazing infill, and resist the cyclic pressure loading with no tear longer than 5 inches and wider than  $\sqrt{16}$  inches through which air can pass. Test reports or product approval documents indicate a description of the test specimen and components, the maximum size, the pressure rating, and type of impact for which the product is approved.

Common glazing materials include traditional PVC laminated glass for small-missile impact-resistant systems, and PET laminated glass and glass-clad polycarbonate for large-missile impact-resistant systems. In almost all cases, the glazing is attached to the frame using structural silicone sealant.

Finally, it's not always practical or economical for existing window/wall frames to be retrofitted and be certified as impact resistant. Rather, it's far more cost effective to replace the entire unit with pre-tested, rated, and approved systems.

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