

SOLVING COASTAL AREA  
ARCHITECTURAL GLAZING ISSUES:

Hurricane Impact Glazing  
Systems and Solutions

A new generation of glazing materials provides fire-protective assemblies for high-velocity hurricane zones.

**ABSTRACT**

With each project, architects in coastal areas face a facade problem: essentially, how to incorporate ample glass to meet a building's aesthetic and daylight needs while accommodating stringent codes that protect occupants from fire and structures from hurricane-force winds.

## INTRODUCTION

With each project, architects in coastal areas face a facade problem: essentially, how to incorporate ample glass to meet a building's aesthetic and daylight needs while accommodating stringent codes that protect occupants from fire and structures from hurricane-force winds.

Existing window and curtain wall solutions are either fire-rated or certified for use in hurricane-prone coastal areas, forcing architects to implement add-ons such as shutters to meet code, create expensive double-wall systems or reduce glazing altogether.

Vetrotech Saint-Gobain has developed a new, single-product solution: the first Florida-approved glass curtain wall system that is both fire-rated and hurricane impact-resistant.

Launched in March 2014, the Vetrotech HI system is listed by the Florida Building Commission and certified to meet the stringent requirements of the Florida Building Code, including those for the High Velocity Hurricane Zone (HVHZ) that includes Miami-Dade and Broward counties. It also includes Vetrotech's proven fire-resistance technology, uniquely qualifying it for both designations by combining fire-, impact- and pressure-tested glass with a high-strength yet slim steel curtain wall frame.

Vetrotech HI is an energy-efficient, low-maintenance and hassle-free alternative to fire or hurricane shutters for schools, hurricane evacuation shelters and critical-care facilities like hospitals, police stations and emergency rooms. The product, listed by Underwriters Laboratories for up to two hours of fire-resistance, will fill the demand for a fire-rated product for buildings within one mile of a high water mark, where 100-mph-plus wind speeds can turn wind-borne debris into window-penetrating missiles during a hurricane that can last for hours.

## THE DEMAND

Since Hurricane Andrew blew through Florida and Louisiana with wind speeds of up to 165 mph in 1992, the demand for impact-and-windload resistant building materials has surged among commercial and residential builders and property owners. The most costly natural disaster in U.S. history until Hurricane Katrina in 2005, Andrew destroyed more than 25,000 homes, 59 healthcare facilities, 31 public schools and 82,000 businesses, according to estimates by the National Hurricane Center and the Insurance Information Institute.

A Dade County Building Code Evaluation Task Force determined afterward that the penetration of windows and doors by wind-borne debris caused much of the property damage. Research published in the March 2005 *Journal of Architectural Engineering* confirmed that those window and door failures resulted in increased internal pressure, which led roofs to lift, wind and rain to enter the buildings, and building frames to collapse.

Two years later, an updated South Florida Building Code required hurricane protection for windows, doors, skylights, storefronts and curtain wall systems, a rule that the Florida Building Code adopted in 2002 as part of its HVHZ provisions for Miami-Dade and Broward counties.

A decade and several major hurricanes later, when the 26-member Florida Building Commission reduced wind standards for inland areas and northern Florida, it slightly increased wind loads—a measure of how much pressure buildings should be able to withstand—in those two coastal counties.

*“Vetrotech Saint-Gobain has developed a new, single-product solution: the **first** Florida-approved glass curtain wall system that is both fire-rated and hurricane impact-resistant.”*

## THE STATUS QUO

Since Florida adopted its hurricane-zone standard for windows, the requirement for high-impact glass of various strengths has spread to exposed areas in neighboring coastal states and has spawned an industry eager to satisfy the growing demand. Several manufacturers created window and door systems that can survive a punishing blow from a speeding, airborne two-by-four and comply with the Florida code.

At the same time, demand grew for fire-rated windows, doors and curtain wall systems as land available for new construction became scarcer and infill projects—sometimes squeezing large structures into spaces as little as 10 feet away from the buildings next door—became common.

For those buildings to comply with local and state codes, their adjacent walls, including windows and doors, typically must have 60-, 90- or 120-minute fire ratings, depending on how close they are, to prevent a fire in one from igniting the other.

Similarly, as the building boom of the early 2000s climbed toward its peak in 2006, communities with growing populations built more schools, hospitals and other public facilities, which also require fire-rated exterior windows in rooms that line the hallways that occupants would use to escape during a fire. The one to two hours that the fire-rated exterior walls, windows and doors in those rooms might contain the fire make the flames less likely to spread to the escape route before people can flee to safety.

Add to the mix an enduring design trend that favors natural light and open spaces in commercial buildings, a style that has further fueled the demand for both fire-rated and high-impact windows and glass curtain walls.

Architects have their choice of fire-rated windows, doors and curtain wall systems for

infill and public structures, and—thanks to the Florida Building Code—have no trouble finding high-impact glass to specify on buildings vulnerable to hurricane-force winds. Still, they have faced a significant challenge when a single building within a mile or so of the Florida coast requires a product that meets both fire-rated and high-impact provisions.

Their solution, typically, has been to specify high-impact glass and bolster it by attaching massive fire shutters to the curtain wall's exterior. The shutters activate when the fire reaches a high enough temperature to snap or melt the devices' assembly, causing the shutters to drop down. Then, the shutters protect the glass from breaking and allowing the fire to travel to the inside of the building.

Alternatively, architects specify fire-rated windows and curtain walls fitted with hurricane shutters to make them code-compliant.

Shutters have their own set of drawbacks: High winds can obstruct their deployment; they're perceived as unsightly; and they require maintenance between uses.

As an alternative, some architects have designed their own fire-and-wind-resistant systems by pairing a fire-rated window with a second one that is impact-resistant. The makeshift system has proven effective, but it's expensive because it involves two complete window assemblies. Plus, it requires an atypically deep opening in the wall to accommodate the bulk.

Many frustrated designers have simply abandoned their plans to include monumental windows on a hurricane-prone building that also requires fire-rated walls.

Others have met the dual requirements with a fairly common, yet expensive, workaround: They specify two window walls: an impact-resistant wall on the building's exterior, and a fire-rated interior wall a few feet away. In between is a hallway.

## THE SOLUTION

Those expensive and labor-intensive make-shift solutions gradually will be phased out by the use of Vetrotech HI, the first glass curtain that combines fire-rated and impact-resistant glass in a single system.

Vetrotech Saint-Gobain paired its high-strength VDS Curtain Wall profiles with the manufacturer's Contraflam HI glazing to create the industry's first dual fire-and-hurricane glass for windows and walls that is acceptable for use on Florida buildings requiring both protections.

The listed sizing affords flexibility for large panels while allowing accessible doors up to 7080 in an overall assembly that allows for large wall areas of transparent, energy-efficient glazing. Vetrotech HI is UL listed for fire resistance for up to two hours and was tested to meet TAS protocols required by the Florida Building Code. Vetrotech HI also passed the requirements of ASTM's small and large missile test, including dynamic cycling, and air and water infiltration tests.

The dual-rated Vetrotech HI system starts with the manufacturer's proven fire-resistant Contraflam glazing, which faces the interior of the building. As with all other Contraflam products, Contraflam HI glazing features transparent intumescent interlayers, which react when exposed to fire to protect the unit's integrity and limiting the amount of radiant heat, yet still allows for high light transmission and visibility. To also meet the requirements for flying debris impact, an additional laminated component is introduced to the make-up.

The design of the glass layers is such that if the glass is hit with flying debris it will survive the impact, thereby not compromising the integrity of the exterior building envelope and preventing the building's interior from becoming pressurized to the point that its roof blows off, causing the structure to implode. Holding the layers in place is

Vetrotech's fire-resistant steel VDS Curtain Wall, designed for applications that require high-span, self-supporting construction. An interior member that is nearly 6 inches deep and a structural member, along with a proven gasketing system and screw pressure system, hold and retain the glass. Finish options include powder coat; enamel and stainless steel; or aluminum cover.

The resulting combination of framing and glass achieves both the required fire rating and protection desired in HVHZ conditions.



**Figure 1:** Contraflam fire-rated glass in VDS Framing are key components in Vetrotech HI's make-up.

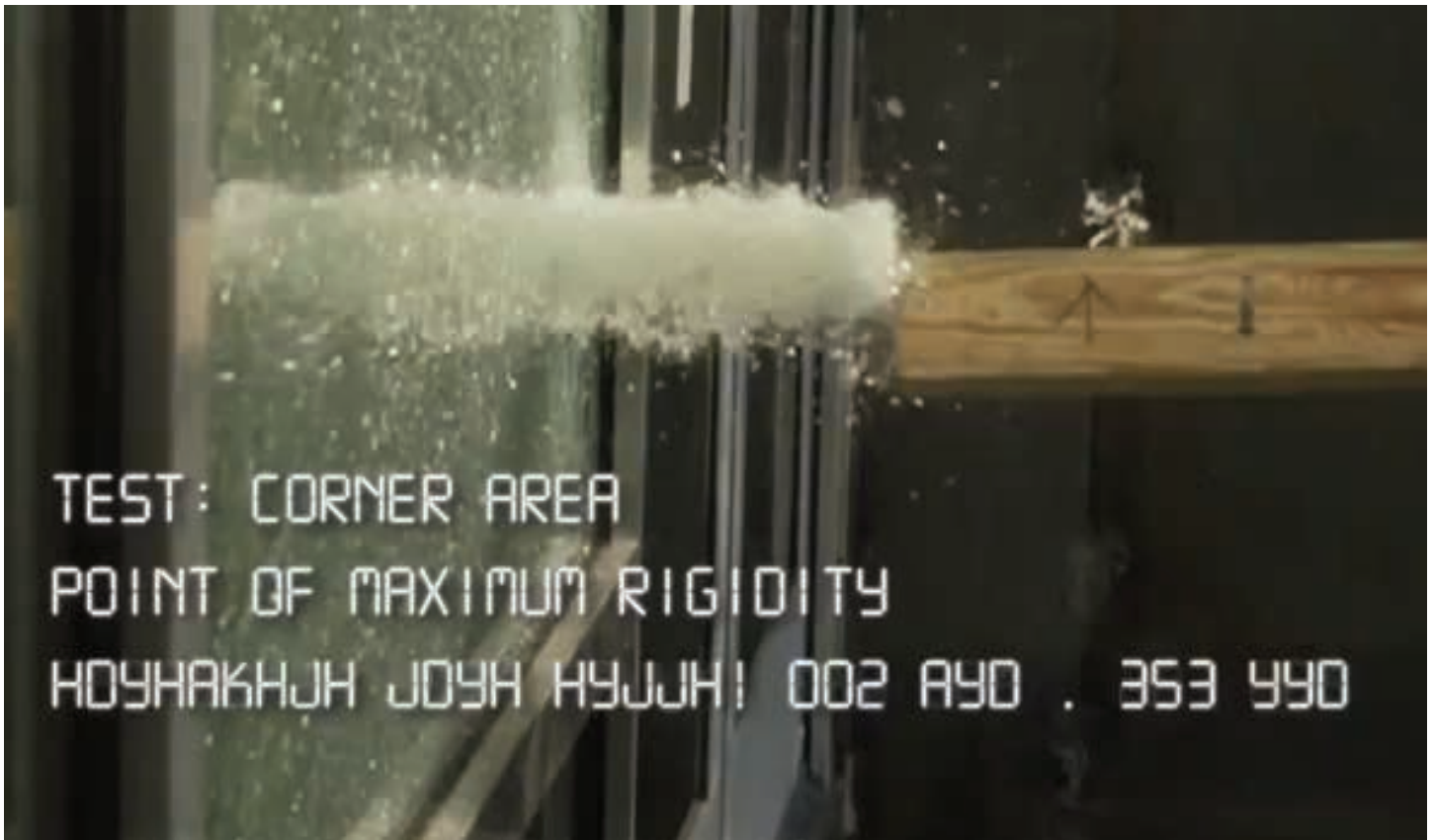


Figure 2: Footage from Vetrotech HI's hurricane impact test

## THE TESTS

To earn a listing from the Florida Building Commission and to assure architects and building owners of the life-safety features of the assembly, the manufacturer subjected Vetrotech HI to rigorous testing for impact resistance.

The test confirmed that the Vetrotech HI glazing retains its properties when subjected to extreme wind pressure and forceful impacts to simulated wind pressure equivalent to 220 mph.

In a simulation chamber, testers used gradually increasing positive and negative pressure against the unit for 9,000 cycles to simulate the hurricane-force wind beatings it would take during an hours-long storm. The system

did not dislodge, which indicates that the unit would stay intact and in place during foul weather—preventing internal pressure from building inside the structure.

The assembly also has been tested to meet the requirements for one- and two-hour fire ratings, which are in accordance to ASTM E119 and NFPA 252.

Vetrotech HI meets the requirements of TAS 201, 202, 203. In addition, the system meets ASTM E 1996 / 1886 / 330 / 283-99 / 331-00 and AAMA 1304-02 test standards.

It carries Florida Building Commission product approvals FL16922 and FL16923, as well as UL listings ZHLA.35 and ZHLA.36

## ADDITIONAL BENEFITS

Hurricane Andrew caused \$25.5 billion worth of damage in Florida in one day, and \$1 billion worth in Louisiana two days later. The state's post-Andrew building codes, the grueling testing process and the years of engineering that Vetrotech Saint-Gobain invested in the creation of the world's first Florida-approved fire-and-hurricane-rated glass undoubtedly will pay off in terms of prevented damages and property loss during future storms. For the team that created Vetrotech HI, however, the potential of the product to save lives during a hurricane is the greater contribution to building science: Andrew killed 26 people, according to the National Hurricane Center.

In addition, Vetrotech HI, because of its atypical strength and ability to stubbornly remain intact despite unremitting blows, is a deterrent to burglars and other intruders. Designed for commercial, institutional and healthcare facilities, the large-size glass is also an attractive option for hotels and condominiums that require fire and hurricane protection as well as safety. An option is available for bulletproofing.

Also, because the system puts a glass-and-gasket buffer between the metal components of the VDS Curtain Wall frame, it moderates the sound that passes through the lites from the outdoors to the building's interior.

The STC (Sound Transmission Class) rating of Vetrotech HI is between 40 and 46, depending on the fire rating, which determines the number of layers. (By comparison, a single-pane window is noisier, with a typical STC value of 27, while a "soundproof" window has a higher average STC value of 48.)

Vetrotech HI's design offers inherent energy efficiency, which is amplified when combined with options such as low-E coatings or electrochromic daylighting controls. A building's architect has the flexibility to design the system's outboard lite to meet local energy standards set by building codes or to achieve LEED credits.

The numerous benefits of Vetrotech HI carry a price premium of 10 percent to 15 percent compared with exterior fire-only or impact-only systems—but those costs are offset when considered against alternative compliant solutions. Building owners can save money on operating costs if they opt for Vetrotech HI instead of buying hurricane-resistant glass and then covering it with fire shutters. And the higher price point remains considerably lower than the cost of designing, purchasing and installing separate fire- and impact-rated systems together in a single opening, not to mention the aesthetics and long-term maintenance costs and reliability of shutters.

Further, insurance premiums often are lower for buildings equipped with impact-resistant glass, even outside of high-risk areas whose codes require it. Rates reportedly increased by 10 percent-plus for structures that were damaged when Hurricane Charley blasted inland Orlando in 2004.

### *About Vetrotech Saint-Gobain*

**That Vetrotech Saint-Gobain is the first to market with an innovative glass product that combines fire and impact protection in one system is consistent with Saint-Gobain's 350-year history of research and innovation as well as the manufacturer's past offerings.**

**Vetrotech has also paired its fire-rated Contraflam glazing with bullet- and burglar-resistant glass (Contraflam Ultimax) and in a frameless interior system that allows for greater design flexibility (Contraflam Structure), among other advances.**

**Vetrotech Saint-Gobain's products have been available to the North American market since the 1980s. The company has manufactured fire-rated glass at its state-of-the-art factories near Seattle since 2000.**