Eneref Institute

PR FOR PLANET EARTH™

A REPORT ADVOCATING FOR SOCIALLY RESPONSIBLE SUSTAINABLE DEVELOPMENT

ENFORCING MANDATORY ROBUST BUILDING CODES **FOR STEEL WINDOWS**

ENEREF INSTITUTE EXAMINES THE BENEFIT-COST RATIO OF CODE-COMPLIANCE ENFORCEMENT AND ABOVE-CODE CONSTRUCTION FOR WINDOWS & DOORS.

The growing number of property and casualty insurance claims is just one indicator of our changing weather. For fiscal 2017, North America was the least profitable region for P&C insurance companies due to losses from climate change. At a minimum, strengthening the building envelope with the currently mandatory building codes will prevent damage from climate change and offer life-safety as well as cost benefits.

STEEL WINDOWS STRATEGY FOR **REDUCING P&C LOSSES**

Improvements made to homes and buildings to protect them from hazardous winds pay $5 in savings for every $1 spent, according to the Federal Emergency Management Agency (FEMA). A 2017 study by the National Institute of Building Science (NIBS) shows that every $1 spent on designing and constructing new buildings to exceed the provisions of the 2015 model building codes developed by the International Code Council (ICC) saves $4 in future disaster costs. A study by the Insurance Institute for Business & Home Safety (IBHS) found a 60% reduction in the severity of hurricane-related damage to homes built to stronger building code standards.

Therefore, Eneref Institute calls for stronger enforcement of mandatory codes and "above-code" construction to ensure windows and doors are properly tested to protect against weather events.

WINDOWS & DOORS MARKET

Research by Global Market Insights projects that door and window sales will grow to $260 billion by 2024, of which 60% will stem from the residential home market and 40% from the commercial building sector. Relying on mandatory building codes, the leading US window manufacturers (such as Andersen, Pella, Velux, Marvin, Jeld-Wen and Hope's) test the integrity and durability of their product lines. Tests include resistance to air, water, structural damage and thermal intrusion as well as tests for impact, fire and forced entry.

In the United States, the codes are established by a number of local, national and international standards organizations: the American Architectural Manufacturers Association (AAMA), the International Building Code (IBC), the American Society for Testing and Materials (ASTM) and the American Society of Civil Engineers (ASCE). In areas prone to extreme weather, steel window frames are often specified for their strength and endurance while maintaining a thin profile and narrow sightline.

NOT ALL STEEL WINDOWS TESTED THOROUGHLY

All window and door manufacturers should follow the same testing criteria for air, water and structural integrity. Although custom manufacturers naturally want to leave their window specifications more open-ended for engineers' preferences, they should still adhere to the same mandatory testing. However some steel window fabricators undercut the market-average price-point by testing only for thermal resistance—leaving structural integrity, and the potential for damage, to chance. Repair costs incurred from weather events are borne by the homeowner or building owner, and ultimately the underwriter.

While the major window brands can amortize the cost of testing their product lines to the highest standards, custom window manufacturers must add the cost of rigorous air, water and structural testing to the sale price of each window. However, some custom manufacturers avoid the overhead costs associated with ensuring that their products perform at code.

"A lot of manufacturers, even big companies with as many as 20 years of experience, have no certification whatsoever and perform no testing, except for NFRC thermal fenestration testing," asserts Jalal Farooq,

Research for this report includes studies and testing by American Property Casualty Insurance Association, American Architectural Manufacturers Association, Insurance Institute for Business and Home Safety, American Society for Testing and Materials and Federal Emergency Mitigation Agency.

CFO of Al Farooq Corporation, a structural engineering firm for glazing-related projects and products. “I would say that is common in a lot of places.”

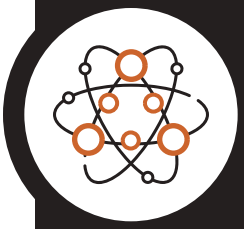
As a result, some custom manufacturers not only exempt themselves from the overhead costs associated with product testing, but they also exempt themselves from the added cost of improving products that have failed testing and should therefore require a higher investment in better-quality materials and still further testing. In fact, Eneref research has found that as many as 50% of steel window manufacturers in the US fail to test their products to assure even a minimum code compliance.

“There are always manufacturers who play outside the rules, and the reason they get away with it is because there’s under-trained building officials,” suggests Joseph Reed, Senior Director of National Certified Testing Laboratories. “You can’t qualify a window to the expected performance requirements in any way other than testing.”

WHY PROPERLY TESTED STEEL WINDOWS ARE ADVANTAGEOUS

Traditionally, window frames are made from wood, fiberglass, vinyl, aluminum composite, steel or bronze. The most structurally secure custom windows are made of hot-rolled steel, and for the North American market, the best of those are still handcrafted in the USA. The steel is heated to an extreme temperature so that it becomes malleable and can be shaped to meet a range of performance criteria. Solid steel windows are considered advantageous by architects for their aesthetic and durability and are a popular choice in new and retrofit construction for luxury residences as well as commercial and institutional facilities.

“Some steel window companies try to do everything the right way,” says Jalal Farooq. “Hope’s Windows, for example, tests



THE *SciBox:*

STEEL WINDOWS DAMAGE CLAIMS

Eneref Institute found five major reasons for property and casualty events from damaged steel windows during severe weather.

1. **CONTRACTORS** *may not comply with code unless compelled by a code official.*

2. **CODE OFFICIALS** *may be unfamiliar with custom window products not listed, that don’t meet code.*

3. **MANUFACTURERS** *may not always test for design load, like the more established brand manufacturers do.*

4. **ARCHITECTS** *are often more focused on energy efficiency and thermal performance.*

5. **INSURANCE COMPANIES** *rely on systems in place, unaware that some windows don’t meet code.*

GLOBALLY, AS STORM INTENSITIES INCREASE, SO WILL THE DAMAGE THEY INFLICT.

In just one year, Hurricanes Harvey, Irma, Maria and Nate caused more than $250 billion in property and casualty damage in the US.

everything. They spend a lot of money to acquire the right product certifications."

DESIGN TESTING

According to research by Eneref Institute, any of five stakeholder missteps could be responsible for window damage during severe weather events. (See SciBox on previous page.) All windows that comply with building codes are tested to meet an air rating for energy codes, a water rating for leaks and a structural load rating to prevent storm damage. However, many building codes today prioritize energy efficiency, or thermal rating, even at the cost of reduced structural safety.

U-VALUE VS STRUCTURAL INTEGRITY

The energy efficiency of windows is measured in W/m K, referred to as the U-value—which calculates the conduction of heat through the window. The better-insulated the window glass, the lower the U-value.

Although structural integrity for storm damage mitigation is a significant life-safety concern, the window market still prioritizes energy efficiency and U-value, even in spite of the recently increasing number of extreme weather events. For example, triple-pane windows are optimal for U-value but can sometimes have less structural integrity and may even be weaker than double-pane windows when thinner glass is used.

DESIGN PRESSURE CALCULATION

Window integrity is tested for the worst-case scenario and rated by the pressure load the window can withstand in pounds per square foot (psf). Window design tests are performed inside a vacuum chamber, creating a uniform pressure along the window. Using air pressure equipment, windows are tested for air infiltration, resistance to heavy rain water, and structural endurance and robustness. Design pressure test requirements can vary by geographical parameters where the windows will be installed.

When window strength is inadequate, the window glazing (glass) or frames can fail. And window anchorage failures can result in the entire window unit being ripped from the wall.

"People will complain about a drafty window, or condensation, or too much glare… You feel and notice that. Whereas you wouldn't really notice if you had a structural performance problem with your window until a severe design event occurs," states Joseph Reed of National Certified Testing Laboratories.

TESTING FOR AIR INFILTRATION

According to the American Society for Testing and Materials (ASTM), residential windows must withstand a minimum air pressure of 1.57 psf without any air infiltration. Higher-grade "architectural" windows require a pressure load of 6.24 psf or greater. Windows can fail if they are not strong enough to resist wind pressures from a high-wind event or if the forces exerted on them exceed the strength of their anchorage. Local code officials must ensure that product certifications are appropriate for the design wind pressures and that window anchorage and glass (components and cladding) are adequate to resist the loads.

Yet, according to engineer

Jalal Farooq, "In certain areas, code enforcement is very lax. Often code officials, who are not professional engineers, are presented with just any kind of certification. They don't check what the certification is in relation to what the code requirements are."

TESTING FOR WATER PENETRATION

Water and structural tests for windows are similar to air tests but require much higher testing pressure loads. For example, a structural test looking for breakage during a weather event may require a 50-psf load test for a duration of 10 seconds. Windows for homes in hurricane-prone areas, like Dade County, FL, may undergo triple the testing duration. Water resistance for residential homes is typically tested at 15% of the design pressure for a duration of 15 minutes. The architectural-grade home is tested at 20%. Even when the windows remain intact, those that are unable to resist local weather conditions and that allow water intrusion cause damage requiring extensive repairs to the space.

While high wind is the most common concern for average Americans during hurricanes, the National Oceanic and Atmospheric Administration (NOAA) has found that it is water that is responsible for nearly 90% of all fatalities—and half of those are due to storm surge.

ADDITIONAL TESTING

Beyond, air, wind, water and thermal intrusion, windows are tested for integrity in other conditions. For fire-safety rating, windows are typically tested to withstand a 45-minute fire. For blast testing, Department of Defense engineers specify a very high pound-per-square-inch blast "in a single instant." Forced entry tests apply 300 pounds of lever pressure in an attempt to crank the window's bracket bolts free.

WORSENING WEATHER CONDITIONS

Kerry Emanuel, MIT hurricane expert, has calculated that Atlantic hurricanes have become 60% more powerful in the last decade. The 2017 Hurricanes Harvey, Irma, Maria and Nate caused more than $250 billion in damage in the US, according to the World Meteorological Organization (WMO). As storms increase in intensity, so will the damage that they inflict. WMO has found that the extent of areas affected by extreme weather events has grown and will continue to do so over the next 10 years. Many US coastal areas are particularly vulnerable.

URGENCY FOR STRICT COMPLIANCE

A more exhaustive look at building codes for windows—and better enforcement of existing codes—will speed up recovery after a weather event, cause less disruption to families and businesses, ease pressure on insurance companies and reduce the need for disaster assistance. Building codes are only the minimum acceptable standard used to regulate the design, construction and maintenance of buildings for the purpose of protecting lives and properties. According to an IBHS 2018 study, only five US states have a very high building code rating for storm resistance: FL, VA, NJ, SC and CT. The same study reports that Texas's loosened building codes contributed to the large losses sustained from Hurricane Harvey.

The investment required to strengthen the building envelope dwarfs in comparison to the money and lives saved by enforcing and expanding building codes. To prevent property and casualty losses, Eneref Institute calls for stronger enforcement of mandatory existing codes and even above-code construction to "Code For Climate" and make steel windows more resilient to weather events. For property and casualty insurance companies, mandatory building codes—rigorously enforced—will go a long way to reducing costly policy claims.

LEAD BY EXAMPLE.

ENEREF CAMPAIGNS ARE DESIGNED TO CREATE A COMMON UNDERSTANDING OF SOLUTIONS TO GLOBAL WARMING AND ENCOURAGE PEOPLE TO TAKE ACTION.

AS A SOCIETY, we're more likely to act on environmental solutions when knowledge is shared. That is, when every member knows the same information—and knows that every other member shares that knowledge, too. A viral argument becomes common knowledge, and common knowledge becomes action. Eneref Campaigns bring about that positive tipping point by creating the dynamic of common knowledge and the perceived social pressure to act responsibly. We'll ignite a movement so that you can lead others.
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PR FOR PLANET EARTH™

Every organization must harness their capacity to improve our planet and society.

Right now, we need to make unprecedented changes to ensure a sustainable and equitable society. Limiting global warming requires rapid and far-reaching transitions in land, energy, industry, buildings, transport and cities. Every extra bit of warming matters to reduce irreversible harm to our ecosystems.

We encourage organizations to grow sustainably and act responsibly by raising awareness for clear, specific solutions that offer an efficient use of natural resources, demonstrate social responsibility and foster a peaceful, earth-friendly economy.

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