WORRY-FREE WIND DESIGN

An expert in single-ply roofing provides sound advice on how to design roof systems to resist hurricanes and other high-wind events.

By Dave Barista, Managing Editor

During the past 25 years, building damage from windstorms has accounted for approximately 10% of reported total property losses, according to Factory Mutual Insurance.

Among the most common casualties of windstorms are improperly designed and maintained roofing systems. Poorly secured roof edges, air infiltration, and loosely mounted rooftop equipment can all lead to severe damage during a windstorm.

Stan Graveline, VP of technical services with Sarnafil, Canton, Mass., offers the following tips for designing wind-resistant single-ply roof systems.

Wind-resistance starts at the roof edge. The vast majority of wind-related roof damage can be linked to the roof edge. "The highest wind pressure occurs at the edge of the roof," says Graveline. "Typically, air enters under the membrane flashing, causing a blow-off or partial blow-off."

Creating an airtight seal between the wall and roof is the most effective way to prevent wind damage at the edge. "Sometimes contractors don't seal that area properly," says Graveline.

The most basic method for preventing air infiltration in such cases is to apply a gasket-type two-sided tape between the flashing membrane and the face of the wall, assuming it is a relatively smooth surface. A continuous metal hook strip or other type of pressure bar is then fastened through the membrane and the gasket to insure a long-term seal. On highly irregular surfaces like metal wall panels, custom filler pieces are required to insure the voids are filled and sealed.

The roof edge must also be well anchored and secured, says Graveline. Most importantly, make sure that the wood blocking at the perimeter is secured to the wall system with proper nails and fasteners.

"In new construction, the wood blocking is usually installed by a different trade than the roofing contractor," says Graveline. "If that firm does not appreciate the importance of securing the blocking,

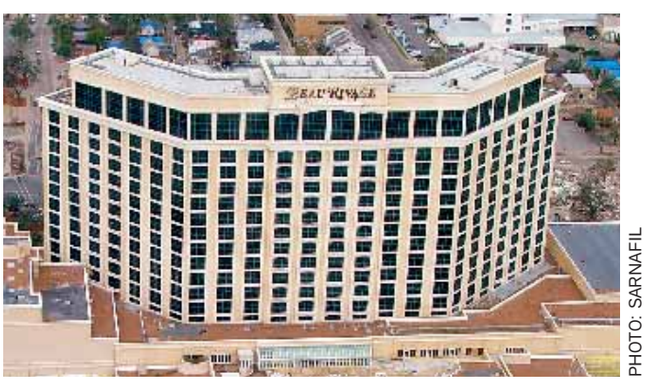

PHOTO: SARNAFIL

The single-ply roof at the Beau Rivage Casino in Biloxi, Miss., survived Hurricane Katrina thanks to proper wind-design techniques.

and the contractor is not paying attention, the whole system could fail. The membrane and metal counter flashing may stay well anchored to the wood, but the wood could come off the deck or wall."

Use of proper fasteners is vitally important. Drywall screws or uncoated nails can jeopardize a roof's ability to resist heavy wind loads. For instance, fasteners with insufficient corrosion resistance will deteriorate over time, potentially leading to roof blow-offs. This issue has become even more critical during the past couple of years when the pressure-treated wood industry, due to environmental concerns, transitioned away from the use of chromated copper arsenate (CCA-C) to treat wood. Newer technologies based on alkaline copper quaternary (ACQ) have been found to be much more corrosive, which can be an issue for both the fasteners and the steel decks the blocking may be anchored to.

Know the difference between wind speed and wind pressure. Even design professionals often erroneously use the two terms interchangeably. Wind speeds need to be converted to pressures by applying the appropriate coefficients to account for a building's sur-

rounding ground roughness and topography, and the roof's height, shape, and slope.

Only a small proportion of buildings are insured by Factory Mutual member insurance companies, but too often designers blindly rely on roofing standards published by these companies, says Graveline. "People don't understand the difference between wind speed and pressure, so they just specify FM 1-90 as the de facto standard, which means 90 pounds per square foot of uplift resistance," he says. "This results in roofs that are vastly over-designed for all but hurricane-prone areas, thereby costing the owner many thousands of dollars more without any additional benefit."

Instead, Graveline says Building Teams should design to comply with the relevant requirements of the building codes. In this case, roof wind uplift designs should be calculated according to the American Society of Civil Engineers Standard 7: Minimum Design Loads for Buildings and Other Structures.

Make sure to combat air infiltration from within. For certain building types, the roofing system should be designed to resist pressure from both the exterior and interior. For example, buildings operating at positive internal pressure, such as cleanrooms and highly sensitive labs, are susceptible to roof damage caused from the pressure within. The positive pressure adds to the load imposed on the roof assembly by wind.

Even buildings not intended to operate at a positive pressure can be subjected to internal forces. The stack effect in high-rise buildings can create unanticipated pressure within the roof assembly. During a high-wind event, buildings that have numerous or large openings, such as warehouses, may be unexpectedly subjected to excessive internal positive pressure. In the extreme, these situations can cause a blow-off at wind speeds lower than expected, says Graveline.

The typical remedies for resisting internal pressure include beefing up the roofing system structurally, incorporating an air barrier/vapor retarder at the roof deck level, and sealing joints, transitions, and penetrations throughout the roof deck.

Don't forget to secure rooftop equipment. Even the most impeccably designed roof has no chance against a windstorm that sends rooftop mechanical equipment tumbling about. Poorly secured rooftop equipment can cause extensive damage to roof membranes.

"Oftentimes, equipment is simply set on curbs with minimal or no fastening," says Graveline. "These systems are being held by gravity more than anything. "

The appropriate fixation needs to be specified for rooftop equipment. BD+C