Wind Performance of Metal Roofing

Q: We build primarily in high-wind zones in Florida and North Carolina, where we have had our share of shingle blow-offs in the past 30 years (though many fewer with heavier "storm-rated" shingles attached with a six-nail pattern). These days, there is much more interest in standing-seam metal on residential projects. Does metal perform any better than asphalt in high-wind storms, and are there general recommendations for selecting and attaching metal roofing specifically for high-wind zones?

A: *Rob Haddock responds:* Metal roofing can hold up surprisingly well in high wind. I first went to South Dade County two days after Hurricane Andrew to study the performance of steep-slope steel roofing in hurricane-force winds, and I have evaluated the damages from numerous tropical storms since. I have seen less damage to steep-slope, standing-seam steel roofing than to any other roofing type.

When it comes to wind resistance, metal roofing has some distinct advantages over conventional roofing materials. After all, a metal panel is a structural element; its behavior under load can be calculated and tested. In addition to being predictable, metal stays consistent as it ages; its behavior does not change significantly over time the way asphaltic, synthetic, and wood roofing does. In other words, metal roofing panels are engineered systems that can be designed to withstand any wind pressure. A panel's resistance to blow-off depends on the panel gauge, the sectional geometry, and the frequency and method of attachment.

As wind passes over a house, it typically tries to suck the roof off. This "uplift" effect is more pronounced in certain areas of the roof than in others. The roof's edges and particularly corners are especially at risk. On steeply sloped roofs, the area along the ridge is also subjected to greater uplift pressures. In Dade County, the few failures I saw were at the juncture of the ridge and rake at the peak on gable-end roofs.

Metal panel systems are tested or engineered to meet specific requirements. When they are tested, the most widely accepted test procedure is Underwriters Laboratories' UL-580. For this test,

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The behavior of metal roof panels under load can be calculated and tested. And that predictability stays consistent as it ages — unlike asphaltic, synthetic, and wood roofing.

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the panel assembly, including the metal panels, fasteners, and substrate, is placed in a 10-by-10-foot chamber. Pressure is then applied, cycling between positive pressures (from beneath the assembly) and negative pressures (from above the assembly). Depending on how the assembly responds, the panel is designated as UL Class 30, UL Class 60, or UL Class 90. (These are comparative levels of performance; the numbers do not correspond to any performance criteria.) Class 90 is the highest rating; these panels survive test cycles that expose them to as much as 105 pounds per square foot (psf) of positive and negative pressure.

Since this is the best measure of a panel's true resistance to blow-off, it is important that the assembly is constructed in the field the way that it was tested. The exact specifications may be available from the manufacturer. To be sure, check the *UL Building Materials Directory* (available from Underwriters Laboratories, Publications Stock, 333 Pfingsten Rd., Northbrook, IL 60062; 708/272-8800, www.ul.com/info/uldirs.htm). This book comes out periodically, showing the details of the roof constructions for each classification.

The other approach is to convert design wind speed (mph) into uplift force (psf) in accordance with ASCE-7. (A registered engineer would do this.) The resulting uplift forces will vary in different areas of the roof, requiring more frequent fastening in perimeters and corners. Another test procedure, designated ASTM E-1592, is used to verify that the assembly can withstand the required uplift pressures thus calculated. This test results in a quantitative pressure in psf. The results will vary with gauge, attachment spacing, and so on.

As a rule, wind resistance can be increased by increasing the panel gauge, decreasing the panel width, and increasing the fastening schedule. In any case, the panel manufacturer should be able to give you some direction in specifying the gauge, profile, and fastening. Most panel manufacturers have a registered structural engineer on staff who can make recommendations in specific applications. But, if you are building in Dade County, Fla., no testing except Dade's own is recognized, and there are a few metal roof manufacturers who have Dade approvals.

Rob Haddock is the director of the Metal Roof Advisory Group in Colorado Springs, Colo., and a former roofing contractor.