The Importance of Properly Securing Low-Slope Roof Edges

by Frank Resso, PE

Wind Damage to Roofing

The inability of a roof to resist severe rain, snow, or icing conditions often manifests itself fairly soon after the roof is constructed. For reputable roofing manufacturers and contractors, this imposes a certain amount of pressure to do the job right, if they want to retain their good reputation. On the other hand, it is possible that a roof may only face the onslaught of severe wind conditions once in its lifetime, or not at all. Perhaps this is why roofing innovations to improve resistance to severe wind have been slower to be implemented. However, when a roof fails under high winds, the results can be devastating.

In a majority of cases, particularly regarding low-slope roofing, proper attention to the edging systems is all that would be required to avert disaster, because most of the time, it is the failure of the perimeter securement that leads to roof blow-offs and other failures due to even moderate wind events.

Industry Resistance to Proper Securement

According to commercial insurer FM Global, 59 percent of insured losses involving built-up roofing (BUR) were the result of edge-securement failure. Similar observations have been made by the Roofing Industry Committee on Weather Issues (RICOWI), a nonprofit research organization assisted by Oak Ridge National Laboratory. Take a moment to reflect on that – almost 60 percent of roofing failures due to high wind conditions *would not have happened* if proper edge securement were being used.

Some of these reports date back, for instance, to Hurricanes Charley and Ivan in 2004. One RICOWI report states explicitly, "codes that require secure roof edging [need] to be enforced."

And, to put that all in context, the insurance industry estimates that wind-related events cause more than half of *all* insured disaster losses, which amounted to over $300 *billion* between 1988 and 2007.

Although building code requirements are in place for the performance testing of edge metal systems for roofing, these statistics illustrate that there is a lack of adequate implementation and enforcement in the industry.

The International Building Code (IBC), for example, mandates performance testing requirements that would greatly reduce losses if they were properly implemented (Section 1504.5, Edge securement for low-slope roofs). These specifications are in accordance with ANSI/SPRI ES-1.

Testing for Compliance

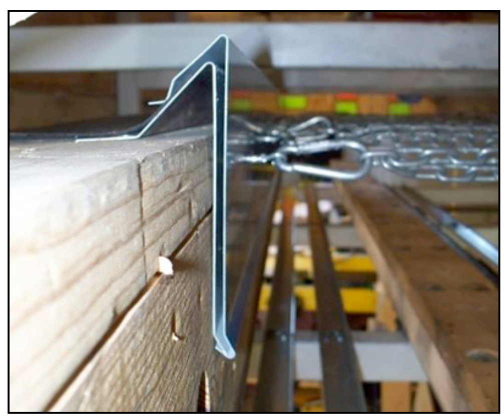
The ES-1 standard specifies procedures to:

- Determine what the resistance of an edge-securement system should be for a specific application
- Test the capacity of given edge-securement devices or systems

The first procedure, RE-1, is called the "Membrane Pull" test, and is used for fascia and gravel-stop systems. It applies only to non-fully adhered membranes, which can easily separate from the edge securement. Fully-adhered membrane systems are exempt from this test.

To perform RE-1, sample specimens are constructed according to manufacturer specifications and project details. A pulling force is then applied to the membrane at the edge at a 45-degree angle. The assembly is considered to be in compliance if it demonstrates a specified minimum resistance. The minimum resistance for ballasted roof systems is 100 lb./ft. For mechanically attached systems, a value is calculated based on fastener spacing and applied wind pressure.

The second test procedure, RE-2, is called "Pull-Off Test for Edge Flashings." It applies to fascia and gravel-stop systems having an exposed horizontal component of 4 inches or less. For this test, a full-size specimen not less that 8 feet long is constructed, and loaded in such a way that the vertical leg of the edging is pulled outward, horizontally. The load is then progressively increased. The load is removed in between each test load, to simulate the cyclic nature of wind forces. Interestingly, it is often during unloading that systems disengage and fail. The blow-off capacity is deemed to be the highest load withstood prior to failure.



For systems having more than 4 in. of horizontal exposure, test RE-3, "Pull-Off Test for Coping," is used. It is similar to Re-2, but it requires the wall coping system to be loaded in both an upward direction (on the horizontal face) as well as an outward direction (on one of the vertically exposed faces). To account for variations in the exposed height and attachment methods of the vertical coping legs, RE-3 requires each system to be tested twice – once while loading the inner vertical leg, and once while loading the outer vertical leg. As with RE-2, loading is progressively increased, while unloading the system in between each test load. The ultimate blow-off capacity is recorded as the lesser of the two measured failure points.

Who Performs the Tests?

Although the building codes require that edging systems must be tested, neither IBC nor ANSI nor SPRI specify which agencies are qualified to perform the tests, nor which systems are to be considered "approved." Given this situation, one measure of assurance might be to specify that these tests be witnessed and certified by an independent professional engineer. Numerous manufacturers of these products have already conducted ES-1 testing in this fashion.

Another important consideration is that when the ultimate ES-1 test capacity is applied to building code design, service-level wind pressures are only estimated, based on wind speed maps. It would be a mistake for a designer to assume that a tested edge-securement system that exceeds the calculated design wind pressure is strong enough for a given application, because variations in test values, equipment calibration, construction tolerances, installer craftsmanship, or even instantaneous high-velocity wind events could precipitate a failure. As in most systems designs, a real-world safety factor must be used. The official position of the SPRI ES-1 Task Force Committee is that a safety factor of 2.0 must be applied to the ultimate test value. This factor has been made explicit in the new SPRI/FM4435/ES-1(2010) standard.

Conclusion

A building, and its owners, may be lucky enough never to experience a severe wind event that would tax the integrity of its edge securement. Nevertheless, as with fire-prevention and other safety systems, it is irresponsible to ignore these contingencies. However rarely they occur, their results can be catastrophic. Proper attention to the roofing perimeter can make all the difference between a destroyed building, and one that is properly and responsibly protected against the forces of nature.

Frank Resso, PE, is director of metal engineering for Garland Industries, Inc. Resso has been involved in the design and development of metal roofing solutions for over 13 years. He is heavily involved in the selection, testing, and approvals of metal roofing, wall panels, and edge-securement systems. He is a member of several professional organizations, including RCI, ASCE/SEI/AEI, and ASTM.