

LESSONS LEARNED FROM THE FLORIDA HURRICANES

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The Roofing Industry Committee on Weather Issues (RICOWI) dispatched seven teams to investigate damage after Hurricane Charley hit the U.S. on August 13, 2004, and five teams after Hurricane Ivan made landfall on September 16, 2004. Often, the roof damage witnessed was caused by omissions in installation and design that a good consultant knows could cause problems in high winds. When these fundamental installation details were absent, there was roof damage. In this article, members of the investigation teams provide limited discussion on fundamentals that will help keep the roof covering in place in high winds.

RICOWI's team members are currently drafting a final report. The report and complete findings will be presented at the spring seminar scheduled April 1, 2005, in Miami Beach, FL (just prior to RCI's Annual Convention and Trade Show at the same location).

STEEP-SLOPED ROOFS

Asphalt Shingles

When damaged asphalt shingles were found, they often had been installed with fewer than four nails or staples (often only three). There are two problems: first, staples are not a building code-approved fastening method for asphalt shingles; and second, the building code calls for a minimum of four nails per shingle (minimum six in some locales).

It is absolutely critical that contractors read and follow the manufacturer's fastening requirements for the shingle being

For 4:12 slope and steeper, use Number 1 Grade shingles at 5", 5 1/2" and 7 1/2" exposures for 16", 18" and 24" shingles respectively. For lower roof slopes and lower product grades use reduced exposures (See Page 20)

Two nails (only) for each shingle approximately 3/4" from edge and approximately 1 1/2" above exposure line.

Spaced sheathing should be 1 x 4 or 1 x 6

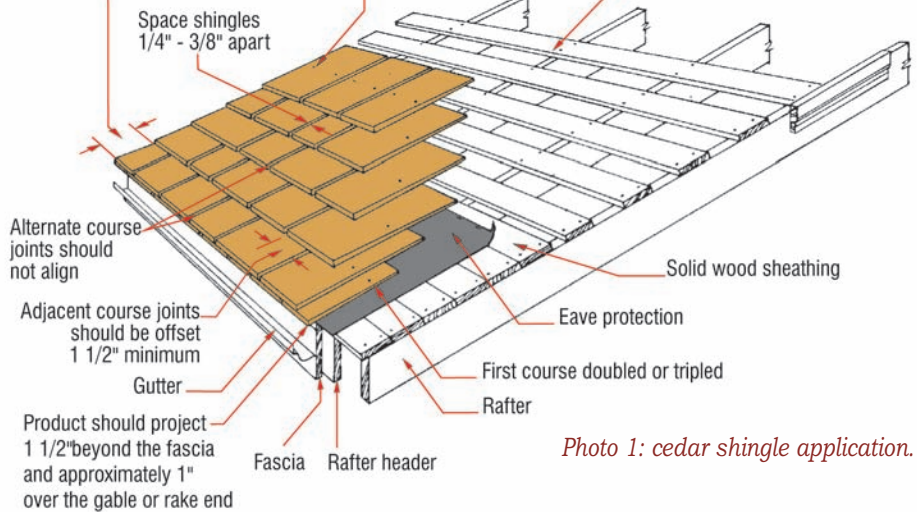


Photo 1: cedar shingle application.

Two nails (only) for each shake approximately 3/4" from edge and approximately 1 1/2" above exposure line.

Space shakes 3/8" to 5/8" apart

The bottom edge of the felt should be positioned above the butt of the shake at a distance equal to twice the weather exposure. Never interlay shingles with felt.

Exposure
Product should project 1 1/2" beyond the fascia and approximately 1" over the gable or rake end
Adjacent course joints should be offset 1 1/2" minimum

Spaced sheathing should be 1 x 4 or 1 x 6
Solid sheathing at eave
Eave protection
Starter course

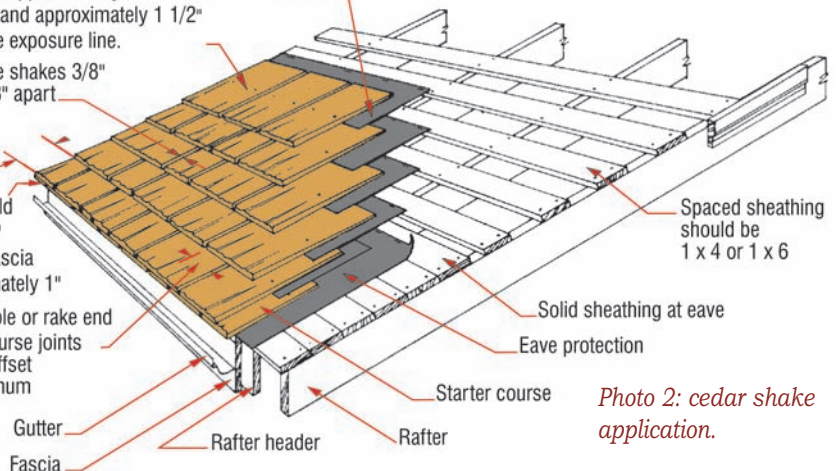


Photo 2: cedar shake application.



Photo 3: Overhangs increase uplift pressure. Special design is required.

installed. When the racking method is used and the shingles are applied by the racking method properly, they can perform well; but too often, the contractor leaves out one nail at the end of the shingle (typically using only three nails), resulting in a weakened resistance to wind blow-off. Some manufacturers discourage the procedure known as “racking,” where the shingles are installed in a vertical pattern, instead of a diagonal pattern. Very often, shingles with evidence of a missing nail were those found on the ground.

Evidence of another poor installation method was witnessed – nailing outside of the prescribed fastening area. On roofs observed to have wind blow-offs, “high-nail-

ing” and nailing into the sealant areas were often seen as the weak points that led to damage. Installation observers should check that the correct number of nails is installed and that they are in the right place. It is essential that the sealant on asphalt shingles sets. This may not occur on the day of installation, but it should be rechecked after exposure to warm, sunny weather.

Cedar Shake & Shingle Roofs

Proper application is absolutely critical to any roofing system, cedar shakes and shingles included. For a cedar roof, the following areas are key elements of a sound wind resisting roofing system:

Correct Fasteners

Roofing contractors should use fasteners that will not rust or break away during high windstorms.

Proper Exposure

Ensure that the cedar shake or shingle is exposed the correct number of inches to the weather; overexposure will dramatically reduce the roof's life and integrity.

Correct Keyways

Follow proper application directions to ensure the shakes or shingles are spaced and applied with side laps as required by applicable building codes; excessively wide or narrow keyways should be avoided.



Photo 4: Typical metal edge damage.



Felt Interlayment

Place approved type of interlayment at correct measurement on successive courses to ensure protection from UV degradation.

Metal Buildings

The metal building team investigated the performance of metal roofing on building systems, as well as on conventional construction. Similar observations were made at both of the hurricane areas investigated. In general, post-Andrew metal roof designs and installations performed well. Exceptions were usually associated with installation problems, insufficient attention to details, or from internal pressurization caused by a breach of the building envelope, typically created by failed accessories.

Metal roofs are either through-fastened or standing seam systems. It is common knowledge that standing seam roofs require better trained installers and are more likely to suffer from poor installation, inspection, or both. The spacing and attachment of clips is essential to the performance, but field seaming is crucial. Failures of standing seam roofs were almost always due to the separation of the seam from the clip.



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Photo 5: Corrosion is common in hurricane prone areas – especially near the ocean.



Photo 7: Edge flashing failure – SPF roof system depended upon attachment to rotten edge nailer.

Photo 6: Old BUR attachment. Improper nailing of base sheet did not provide adequate attachment for BUR or new SPF roof system. Side lap nailing is typically 9" O.C.

Many metal roof failures initiated at the eave, ridge, or rake because weaknesses were introduced there due to details or flashing attachments. For example, the attachment of a gutter should not create a situation where the failure of that component pulls up the edge of the panel. Failures were commonly observed with soffit panels and hip and ridge flashing. These don't appear to always be designed for the expected wind pressures,

and though relatively minor, improvements could be easily realized.

LOW-SLOPED ROOFS

Wind damages ranged from minor to extensive on low-sloped roof coverings. The most common initiating conditions for wind damage were lifting of edge metal and billowing of membranes near windward edges. At most locations, deterioration of roof

attachment systems (e.g., rusted fasteners) and installation variations from typical industry recommendations (e.g., thin gauge cleats) reduced available roof wind uplift resistance and contributed to the wind damages.

Suggestions to enhance wind resistance of installed roof coverings include:

1. Use the currently available high wind roof design guidelines by those

who design and specify roof coverings.

2. Understand common wind damage initiation conditions (e.g., roof edge metal, peel, pressurization of membranes above roof overhangs) and ways to enhance resistance against these conditions.
3. Use calculations from ASCE -7 to determine rooftop wind loads. Use

edge metal products that comply with the building code required ANSI/SPRI ES-1.

4. Use highly durable materials as part of roof attachment systems (e.g., stainless steel or corrosion protected fasteners, preservative treated wood).
5. In hurricane-prone zones, make sure additional perimeter and corner securement as required by Factory Mutual or the membrane supplier is in place. It is advisable to add a secondary securement strap that significantly exceeds the potential uplift load within three feet of the perimeter on membrane roofs to avoid damage.



Spray Polyurethane Foam Roofs

Damage observed on SPF roofs again confirms three very significant points:

1. SPF has tenacious adhesion to any properly prepared surface.
2. Most built-up roofs require additional edge and field fastening prior to SPF application.
3. Proper fastening of edge flashing is essential.

The practice of reusing existing BUR edge flashing routinely resulted in failure.



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Photo 8: SPF edge repair – Adjacent BUR blew off, while the SPF roof only suffered perimeter damage due to inadequate nailing of metal edge flashing.



Photo 9: Edge flashing attachment – metal edge improperly fastened at up to 22" O.C.

SPF roofs over BURs were found with rotten edge nailers and metal flashing fastened at 12" on center and greater. Blown off existing BURs with SPF roofs were seen with base sheet fastening substantially less than the industry recommended patterns. Minor missile damage to the coating and SPF was observed, but this damage was not the source of leaks and could have been repaired with a tube of sealant.

Suggestions for improved performance of SPF roofing include:


1. Remove all edge flashing, inspect nailers and replace as necessary, and install new edge metal fastened in accordance with industry standards.

2. Cut the existing BUR to determine its attachment, and add fastening as necessary.
3. Without cutting the existing BUR, consider adding screws and discs to the 10-foot perimeter at the rate of

one for every 2 sq.ft.

4. Prime new edge metal as recommended by the SPF manufacturer.
5. Ensure that rooftop mechanical equipment is properly anchored.

SUMMARY

In summary, a hurricane does not discriminate. It finds the details that did not work and takes the system apart from there. RICOWI has trained over 80 people to understand wind loading. This training was put into practice in these investigations, and the areas understood to be potential for damage were easily found after the hurricanes. If you design for roofs that will be subjected to high wind, you will want to attend the RICOWI seminar in March to learn more. The findings noted in this article are preliminary. Much more detail will be provided in the final report. 

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