

# Tile Roofs for Hurricane Zones

*As Florida continues to tighten its code requirements for tile roofs, the industry responds with new installation techniques and training programs*

by Charles Wardell

**A**fter hurricanes Frances, Charley, and Ivan blew through Florida in 2004, the Federal Emergency Management Agency (FEMA) sent teams to survey damaged homes and buildings. One of the most common problems the teams found was failure of the roofing system. Although the investigators saw failures with all roofing types, the tile industry was the first to respond with new design criteria and installation details. These details have since been added to the Florida Building Code, and more code requirements are under discussion.

## **EVOLVING CODES**

This isn't Florida's first storm-driven code revision. The last one was in 1997, five years after the devastation left by Hurricane Andrew. Before then, most tiles installed on low-pitch roofs in Florida had been

set in a bed of mortar. Because so many of these roofs failed in 1992, the tile industry developed alternative installation techniques that could better resist high winds, including methods for adhesive and mechanical attachment, which were then included as options in the Florida code.

After Hurricane Andrew, Dow and Polyfoam both introduced a foam adhesive that's much stronger than mortar and which is now used by installers certified by each company. In addition, the Tile Roofing Institute (TRI) developed guidelines for using smooth-shank nails, ring-shank nails, and screws. According to TRI Technical Director Rick Olson, the emphasis was as much on cost as it was on safety. "Mortar was running \$30 to \$35 per square at the time, while our options cost as little as \$6 per square."

Installers quickly warmed to the new techniques.

In a tropical storm, hip and ridge cap tiles turn into deadly projectiles. The solution is to attach hip and ridge tiles to a ridge board, using screws through the tile that penetrate at least 1 inch into the board.



PHOTO COURTESY VERMONT SPECIALTY SLATE, INC.

With few exceptions, most post-1997 roof tiles were fastened in place using one of these systems. The 2004 FEMA survey found that these roofs had a much higher survival rate than those installed earlier.

But some roofers continued to use mortar. Tim Reinhold with the Tampa-based Institute for Business and Home Safety reports that his organization had supported a code-mandated ban on mortar-set tiles in high-wind areas, but he notes that opposition by roof installers was too strong. As a compromise, the industry came out with a code-approved prebagged mortar

with just the right amount of sand and cement.

The 2004 FEMA investigation underlined the weakness of mortar set. Tom Smith of TLS Consulting in Rockton, Ill., who served on the FEMA survey teams, says that the size of the blow-off area of mortar-set systems typically was much greater than for tiles attached with foam or mechanical fasteners. He advises against mortar set, no matter what type of mix the roofer uses. FEMA's *Home Builder's Guide to Coastal Construction* ([www.fema.gov/rebuild/mat/mat\\_fema499.shtm](http://www.fema.gov/rebuild/mat/mat_fema499.shtm)),

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PHOTO COURTESY POLYFOAM PRODUCTS



Mortar-set roof tiles were easily stripped from an apartment building in Punta Gorda by Hurricane Charley in 2004. To improve attachment, both mechanical fasteners, such as screws or nose clips, and adhesive foam are recommended for coastal homes.

PHOTO COURTESY POLYFOAM PRODUCTS



Tiles properly secured with adhesive foam withstood the onslaught of Hurricane Charley over Port Charlotte Harbor, Fla., in August 2004. The only weak link was the rake detail. Best practice calls for a rake board and battens, as detailed in the illustration on page 5.

published in June 2005, also recommends mechanical attachment rather than mortar set in all high-wind areas.

Other industry groups agree. For instance, Reinhold says that IBHS's Fortified ... for Safer Living program, which certifies homes as disaster resistant, has never approved a mortar-set roof. "We've heard comments that tiles are so dense that it's hard to get a good bond. We recommend against it."

## NEW HIP AND RIDGE REQUIREMENTS

Mortar's weakness was further highlighted in 2004 by problems with hip and ridge tiles. The 1997 code revisions had simply neglected these. "Trim tiles had been treated as decorative accessories, so they were not adequately addressed [by the code]," notes Olson. He reports that many roofers were still setting hip and ridge tiles on a bed of mortar, even where they had nailed or screwed the field tiles. Over time, the mortar's grip on the hip and ridge tiles weakened, leaving them without secure attachment. "They

would blow off and become airborne, bouncing across the roof plane, breaking field tiles, and causing other structural damage." This happened even on homes built to current code standards and even on homes far enough from the beach to see considerably lower wind speeds. "We realized that something had to be done," Olson notes.

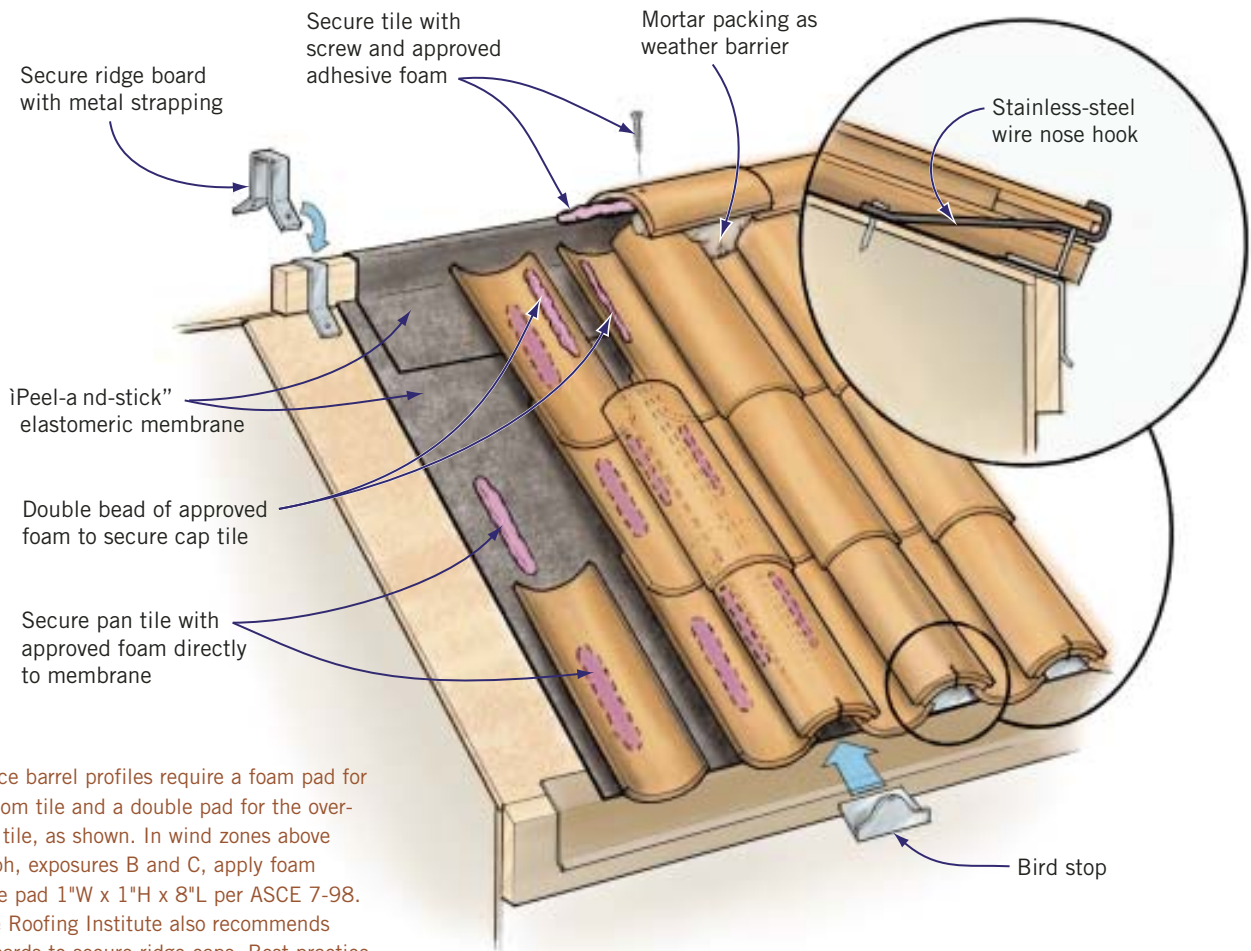
To solve the problem, TRI worked with the Florida Roofing, Sheet Metal and Air Conditioning Contractors Association, Inc. (FRSA) to develop new attachment guidelines for hip and ridge tiles. The new guidelines were

included in the latest edition of the TRI/FRSA *Concrete and Clay Roof Tile Installation Manual*. The manual was released in October of 2005, and adopted by the Florida Building Code in November.

The new guidelines spell out how to properly install hip and ridge tiles. On all tile roofs, the contractor now has to include wood or metal nailers along hips and ridges, and the installer has to

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## ADHESIVE FOAM APPLICATION



ILLUSTRATIONS: CHUCK LOCKHART

Two-piece barrel profiles require a foam pad for the bottom tile and a double pad for the overlapping tile, as shown. In wind zones above 110 mph, exposures B and C, apply foam adhesive pad 1"W x 1"H x 8"L per ASCE 7-98. The Tile Roofing Institute also recommends ridge boards to secure ridge caps. Best practice calls for nose clips to secure the eaves edge, which is most vulnerable to wind uplift.

securely fasten tiles to this board using screws, nails, or a foam adhesive.

Nailers aren't a new idea, of course, but this is the first time they have been required. "Most of the procedures we recommend are not new; they have just now been put into a tremendously detailed document," says FRSA Executive Director Steve Munnell. The new manual's step-by-step instructions and diagrams for doing proper hip and ridge tile installation were based, in part, on the fact that roofs using these techniques fared much better during the storms.

"The folks in South Florida indicated that houses with mechanically attached ridge and edge tiles did better," notes Reinhold.

### UPDATED DESIGN GUIDELINES

TRI has addressed design as well as construction by beefing up its *Concrete and Clay Roof Tile* design criteria. The old version, published in 2002, had just one page dealing with high-wind applications. The new version, released in July 2006, includes nine pages of tables, formulas, and specs for areas subject

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to sustained winds over 100 miles per hour. The tables let the designer calculate uplift forces for various wind speeds on a given tile based on roof type, height, and pitch, and then specify fastener types for that uplift force for different tile profiles and sheathing thicknesses. "We want to help designers select the right options," says Olson. "For instance, one screw or nail per tile may be adequate for areas subject to a certain wind speed, while the tiles on a roof subjected to higher winds will need two nails. The new criteria show them which they need when."

Going forward, TRI will also recommend further code requirements. "Because of the complex architectural designs on many of today's roofs, we're seeing an accelerated wind force against the front edge of the roof," explains Olson. "Because of this, the first course down to the eaves has a lot more poten-

tial to pop off [than the courses above it]. By the end of the year, we hope to analyze and find a better way to attach those tiles."

## INSTALLER TRAINING

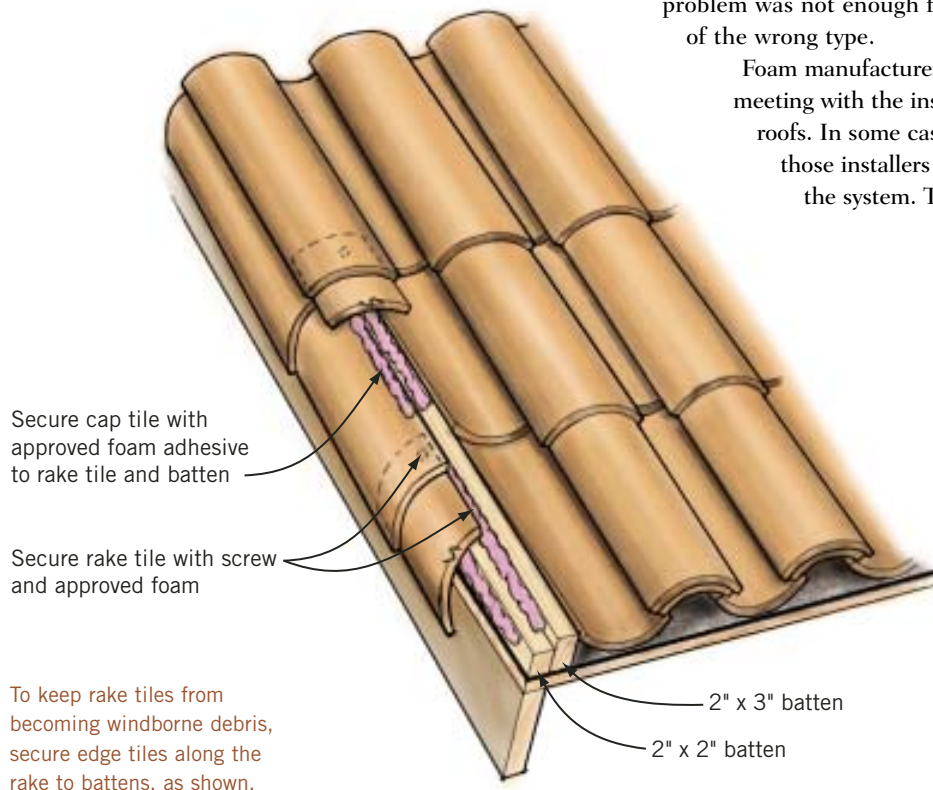
Ever-stricter codes bring the challenge of training installers to follow them, however. Although the TRI/FRSA guidelines have been in place for a year, for instance, Olson says that many roofers and contractors still don't understand them.

In fact, some installers aren't even following the 1997 guidelines. The FEMA teams found some roofs with mechanically attached and foam-adhered tiles that didn't perform as predicted. Olson, who also studied failed roofs after the storms, says that the culprits involved installation problems on both foam and mechanically fastened roofs. On the foam installations that fared poorly, Olson discovered that installers hadn't followed the foam manufacturer's instructions. They used too little foam or didn't put the foam at the right locations on the tile, or both.

With the failed mechanically attached roofs, the problem was not enough fasteners, or fasteners of the wrong type.

Foam manufacturers have responded by meeting with the installers of problem roofs. In some cases, they have made those installers get recertified to use the system. TRI has also launched

## RAKE TILE DETAIL



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a nationwide training initiative to help remedy the problems. According to Olson, the institute plans to have completed four trainings by the end of this year, and it will add programs wherever 50 or more attendees sign up. (Cost is \$195 for TRI members and \$295 for nonmembers.) The two-day program covers installation practices for the entire country but also includes a section on high wind. TRI will also offer a special high-wind training program to Florida contractors in January and February 2007.

Both training programs go beyond fastening. Issues covered include:

- **How to properly lay out a complex roof so that the courses are straight and meet in the right places.**

"A lot of installers are used to straight gables, but today's roofs are architectural focal points with features like dormers and different levels," Olson explains.

- **How to properly flash tile.**

Because of their profiles, tiles often don't sit flat against the roof, and many are installed on battens. Olson has seen tile installations by people not familiar with these conditions in which the flashing actually directs water under them. "Ninety percent of the callbacks we see are flashing related," he notes.

- **How to properly fasten tile.**

Often the fastening tables say to use two screws, but the installer uses only one. Or the installer fastens the tiles with the same 8-penny nails used for the battens, when they're supposed to use 10-penny nails. "It's all because people are in a hurry and they don't think anyone will notice. We want to teach them the importance of following the guidelines."

"There really isn't a training school for these guys," says Olson. "This country isn't like Europe, where there's a long tradition of craftsmanship. And after storms, we see a lot of transplanted roofers from other parts of the country who might not be familiar with how to install tile in Florida. We find that a lot of bad habits get passed down." ~

*Charles Wardell writes on construction topics from Vineyard Haven, Mass.*

## High-Wind Tile Specs

Recommendations for high-wind areas from the *Concrete and Clay Roof Tile Installation Manual*:

- For tiles mechanically attached to battens, tile fasteners should be long enough to penetrate the underside of the sheathing by at least 1/4 inch minimum.
- For tiles mechanically attached to counter battens, the fasteners must be long enough to penetrate the underside of the horizontal counter battens by 1/4 inch minimum, and batten-to-batten connections must be engineered.
- For roofs within 3,000 feet of the ocean, straps, fasteners, and clips should be fabricated from stainless steel to ensure durability from the corrosive effects of salt spray.
- Hip and ridge tiles should be mechanically attached to a ridge board, using screws that penetrate at least 1 inch into the board.
- Where the basic wind speed is equal to or greater than 110 mph, clips should be installed on each tile in the first row of tiles at the eaves, for both mechanically attached and foam-adhesive systems.

## FOR MORE INFORMATION

The Fourth Edition of the FRSA/TRI *Concrete and Clay Roof Tile Installation Manual* can be ordered from the Florida Roofing, Sheet Metal and Air Conditioning Contractors Association, Inc., [www.floridarooft.com](http://www.floridarooft.com); 407-671-3772. This manual covers the proper attachment methods for concrete and clay tiles in high-wind zones, using Florida construction standards. An online copy is available free from the Tile Roofing Institute ([www.tilerooting.org/uploadedFiles/TRI\\_SITE/Become\\_a\\_Member/Florida%20Manual.pdf](http://www.tilerooting.org/uploadedFiles/TRI_SITE/Become_a_Member/Florida%20Manual.pdf)).

*The Concrete and Clay Roof Tile Installation Manual for Moderate Climate Regions*, which covers best-practice installation methods, industry standards, and code requirements, can be ordered from the Tile Roofing Institute, [www.tilerooting.org](http://www.tilerooting.org); 312-670-4177. Cost is \$10.

Foam adhesives come with specific recommendations for installing tiles with their products. For more information, go directly to the manufacturer: Dow Chemical's Tile Bond: [www.dow.com/buildingproducts/tilebond](http://www.dow.com/buildingproducts/tilebond) Polyfoam Products' Polyset One: [www.polyfoam.cc/products/roof/polyset1.html](http://www.polyfoam.cc/products/roof/polyset1.html)