



# The Art & Science of Slate Roofing in the Twenty-First Century

By Matt Millen

**T**he new *Slate Roofs: Design and Installation Manual* being published by the National Slate Association reflects important changes in slate roofing. Changes in recommended slate roofing practices develop from experiences with existing roofs. Problems with installation techniques, system design, and the service life limitations of the materials that were used show up over the long-term life of these roof systems. These experiences affect how the next roof is built. Improvements or modifications in the materials that are developed and introduced by the roofing industry affect slate roofing practices. Market and other economic forces impact decisions on the aesthetic design, sustainability objectives, quality of construction, and life-cycle cost analysis for slate roofs. Here are some examples of how slate roofing has evolved.

## NAILS

Nineteenth- and early twentieth-century problems with iron nails and common wood shingle nails, when used in slate roofs, resulted in the slow change to the now common practice of using copper slating nails. Even in *Slate Roofs*, published in 1926 by the National Slate Association, there was a long discussion on which nails should be used:

The much-mooted question of the material of which the nails should be made must remain a matter of opinion and judgment until an impartial investigation shall throw further light upon the subject.

Hot-dipped, zinc-coated steel nails, galvanized nails, and copper-coated steel nails

were discussed. But because of bad experience with corrosion and difficulty with repairs, none of these fasteners are used today for good slate roofs.

## UNDERLAYMENTS

Before the 1847 development of continuous roll-roofing felts for low-slope roofing, underlayments for slate roofs were not used

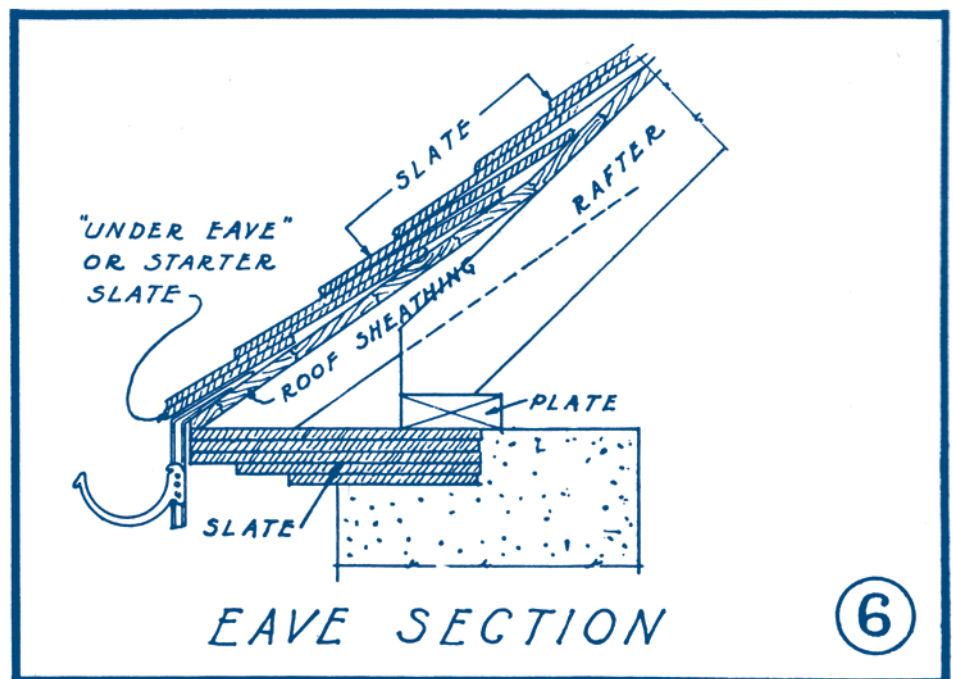
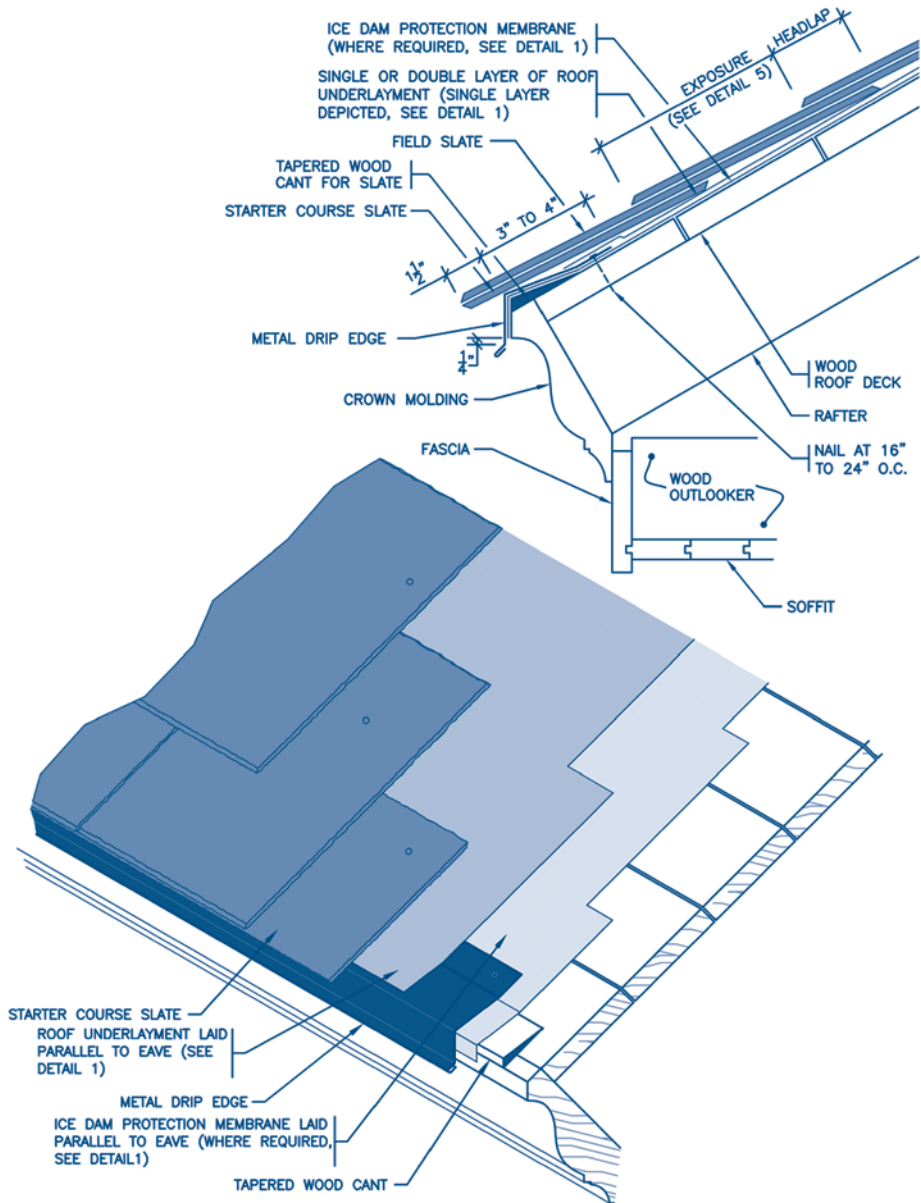


Figure 1 – Eave section drawing from the 1926 National Slate Association manual, *Slate Roofs*.



**DETAIL 2 EAVE FLASHING, CANTS, AND UNDEREAVE SLATES**  
N.T.S.

Figure 2 – Detail 2, eave flashing, cants, and under-eave slate figures from *Slate Roofs: Design and Installation Manual*, copyright National Slate Association, 2010.

in North America. By 1852, specifications for military barracks near Halifax, Nova Scotia, called for slate laid on boards covered with a “McNeill’s patented roofing felt.” By the 1890s, tarred underlayments were recommended for use to keep out fine snow. By 1926, the purpose of underlayments was meant not to improve the watertightness of a slate roof, but to protect the building during construction, to have some insulating value, and to cushion the slate on the roof deck.

Today, underlayments are a building code requirement. In cold climates, adhered and nail-sealing ice-dam protection mem-

branes are required. Underlayments are still used as a temporary roof during construction and as a cushion or separator from the roof deck. But more important, they are now recognized as an essential component of the slate roof system and are used as an integral part of the water shedding system on lower-sloped slate roofs, under drainways, as flashings, and where redundancy is built into a slate roof system. They are also a part of fire-rated slate roof assemblies.

This change in the use of underlayments has been driven by constant improvements in roofing material technology.



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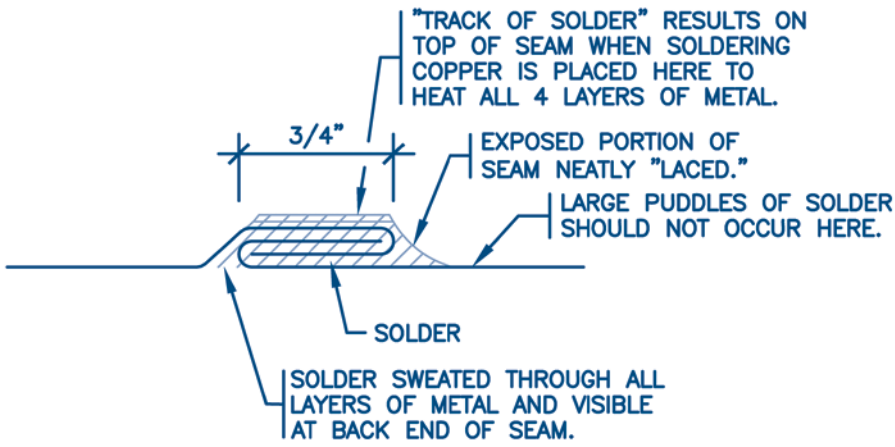


Figure 3 – A locked and soldered seam detail from Slate Roofs: Design and Installation Manual.

created a demand that exceeds the supply of experienced slate roofers and designers. The popularity of slate roofs at all price levels of construction has also put some cost pressure on a section of the roofing market that traditionally was more sensitive to quality and life-cycle cost analysis than to initial cost. Slate roofing, which had been the focus of a limited number of specialists, became a new growth market for the ambitious but inexperienced.

Basic slate roofing principles of installation were not followed on some roofs. Eave canters were not used and slates were over-

One-hundred and fifty years of success and failure with underlayments for slate roofs is directing us toward multiple plies, inorganic fibers, and engineered coatings or saturants that can perform for longer periods on a slate roof. Slate can now be used in a wider range of roof and building designs. Slate roofs can be more functional and last even longer, becoming an important part of buildings that are more cost-effective and sustainable. The use of inadequate underlayments can also negate these benefits.

amount of work being performed by inexperienced roofers and designers. The increased popularity of slate roof styles has

#### SLATE ROOFING SKILLS

A change seen in slate roofing has been the



Figure 2.9: A poorly soldered sample seam. There is little solder within this locked and soldered seam. The solder is primarily surface applied. Seams such as this will fail within months after installation on a roof.

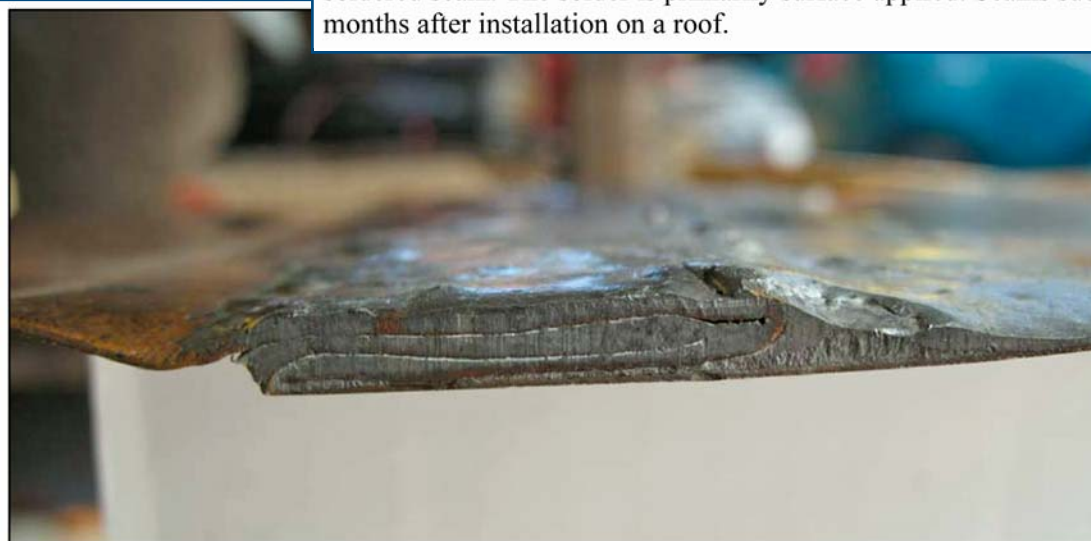


Figure 2.10: A well-soldered sample seam. The surface of the seam is neatly formed ("laced") to cover the leading edge of the metal, and the solder fully sweated through all layers of metal in this locked and soldered seam.

Figure 4 – Figure 2.9 from Slate Roofs: Design and Installation Manual.

Figure 5 – Figure 2.10 from Slate Roofs: Design and Installation Manual.

fastened or unfastened, resulting in stress on individual slates and extensive cracking and breaking when normal forces were applied. Flashing methods for slate roofs were not understood, and shortcuts typical of high-production, commodity roofing were used, resulting in leaks and roofs with shortened lives instead of roofs that could last 150 years, as was previously common.

The slate roofing industry was aware of these problems and realized there was a critical need to update and make available the collective knowledge and experience of the industry. To address this problem, the National Slate Association took on the task of rewriting the 1926 manual, *Slate Roofs*. The objective was to update the manual to ensure an industry-wide consensus on current good practices and to inform and instruct the profession while developing a better public understanding of the art and applied science of slate roofing. The result is *Slate Roofs: Design and Installation Manual*, published by the National Slate Association in 2010.

The new manual covers both basic and advanced aspects of the craft and technology. It provides descriptive and prescriptive information on how to build slate roofs. Multiple methods for executing details are provided to reflect different practices across North America and the important craft aspect of this type of roofing.

The new manual's approach to a fundamental part of a slate roof is apparent in its analysis of the roof eave. Sixteen detailed notes and a section drawing of the eave cant, with five variations, are depicted. A method of constructing a small radius-swept eave is detailed in the section, to

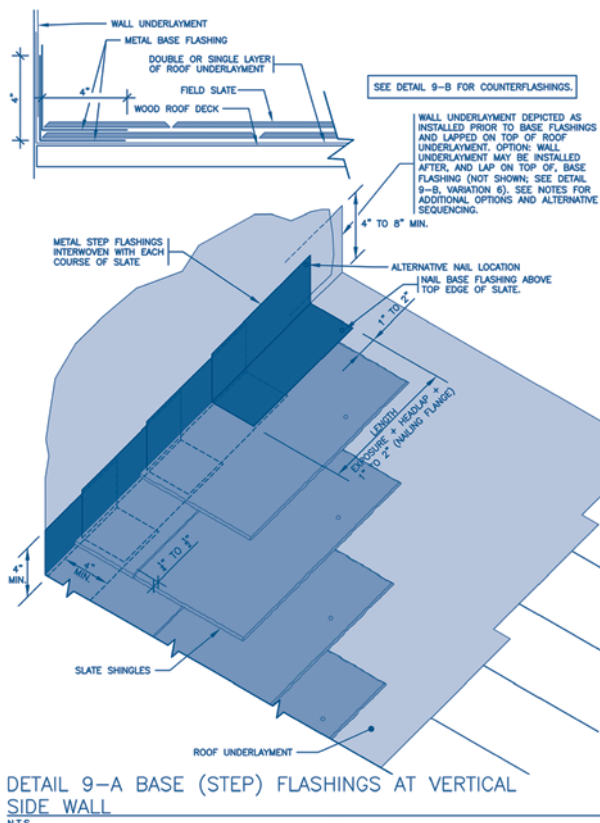


Figure 6 – Detail 9-A from *Slate Roofs: Design and Installation Manual*.

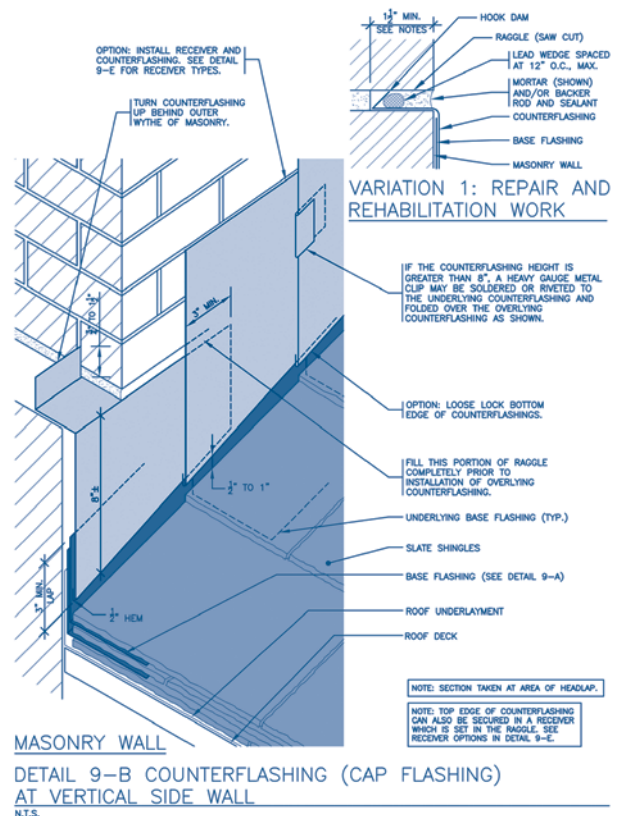
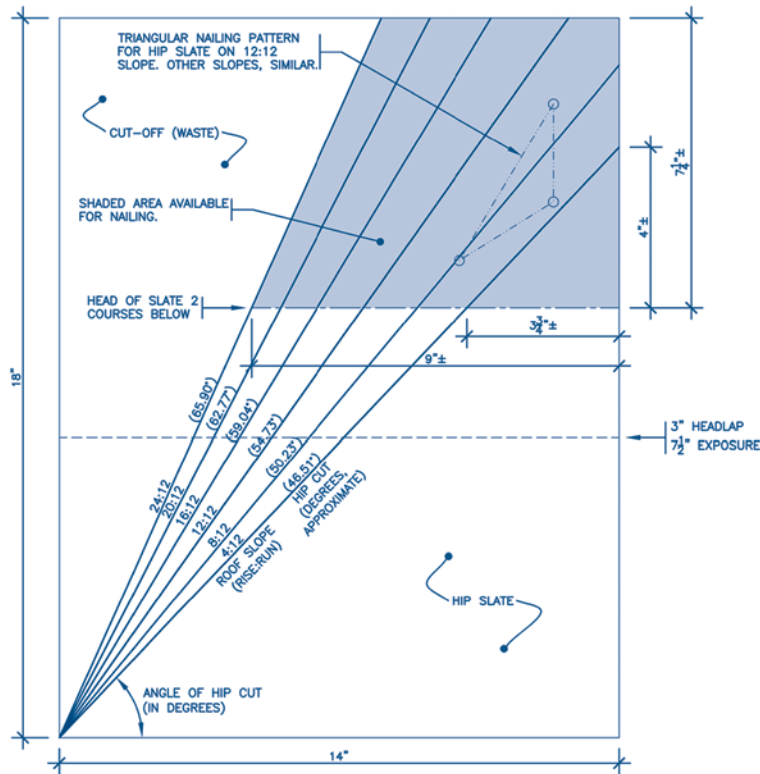


Figure 7 – Detail 9-B from *Slate Roofs: Design and Installation Manual*.



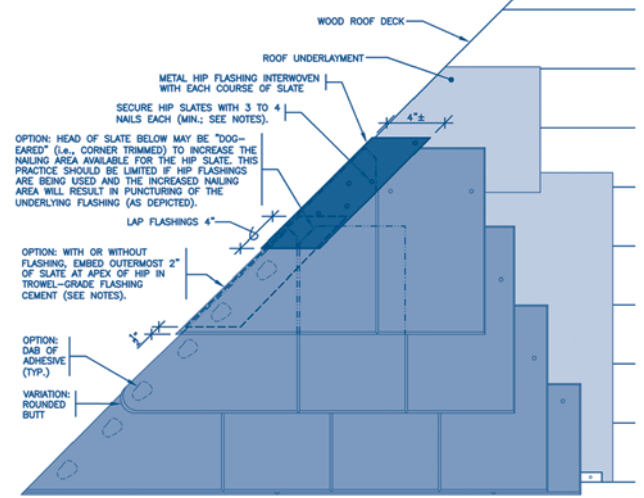
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DETAIL 12-F MITER HIP CUT FOR VARIOUS ROOF SLOPES  
N.T.S. (RIGHT SIDE HIP SHINGLE SHOWN)

Figure 8 – Detail 12-F from Slate Roofs: Design and Installation Manual.

Figure 9 – Detail 12-B from Slate Roofs: Design and Installation Manual.



DETAIL 12-B MITERED HIP  
N.T.S.

show how hidden flashings provide the continuity of multiple water-shedding layers with a building code-prescribed headlap. Plan and section details of a graduated slate-eave layout show the need for the additional inch of headlap at the transition courses. Compare Figure 1, from *Slate Roofs*, published in 1926, with Figure 2, from the new manual.




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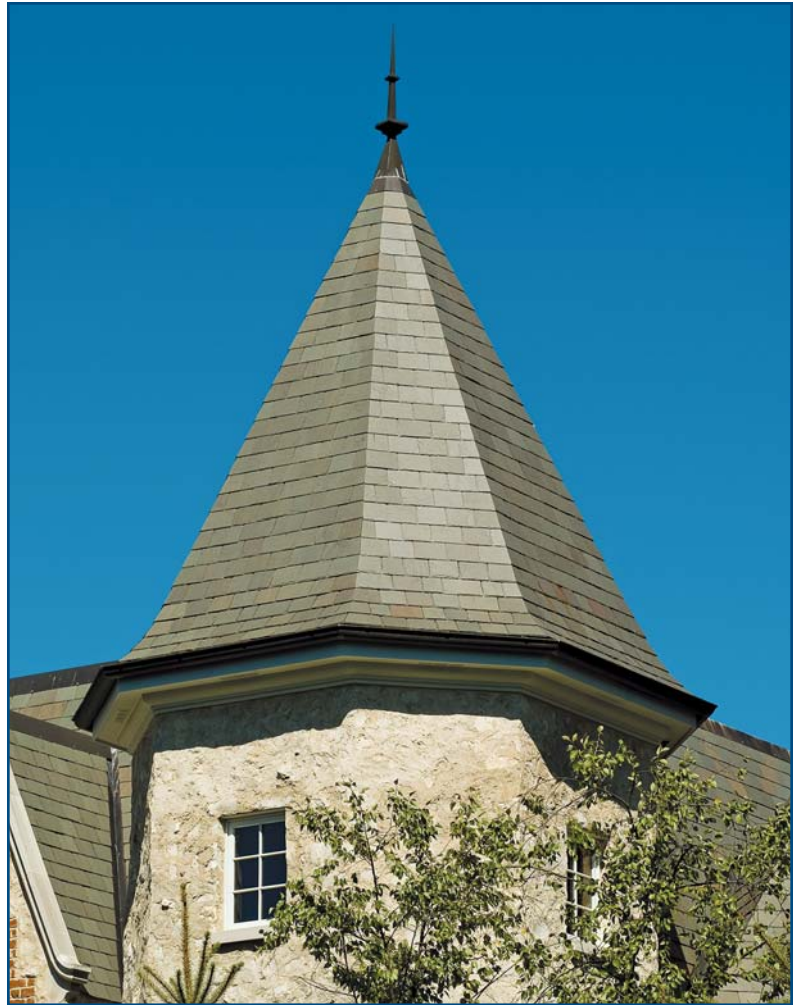
Figure 10 — Mitered hips using a semiweathering grey-green Vermont slate, 16-in long, random width, ¼-in thick, Elm Grove, WI.

#### INTEGRATION OF SLATE ROOFING AND SHEET METAL TRADES

In many locations, the traditional separation of the slate roofing trade and the sheet metal trade has disappeared. Installation of underlayments, metal flashings, and slate shingles is done in a completely integrated operation with one single responsibility. When the slate roof system is treated as a whole, the problems at the interface of membrane, metal, and shingles are reduced. *Slate Roofs: Design and Installation Manual* describes in detail essential flashing areas and metal work issues. See *Figures 3* through *7* for examples of how soldering and wall flashings are handled.

#### MITERED HIP AND THE ROLE OF CONSULTANT AND DESIGNER

Mitered hips are slate roof details that are admired for their clean, classic, and minimalist lines. They are also one of the high points of slate roofing that requires knowledge and experience to master. As consultants and designers have taken on a more important role in the slate roofing process, they need to describe details that are difficult to specify and have to rely on contractors' skills to realize them. A mitered hip is the type of detail that requires consultants and designers to understand the technical demands of miter-cutting slate and three-point pivot and counterbalance nailing. The limitations in the nailing area for each slate should also be considered when using this method of hip construction. This holds true whether descriptive or prescriptive specifications are used. See *Figures 8* and *9* for a sample of the type of traditional roof craft information and analysis that is now, for the first time, available in an easily accessible form to advance professional understanding of how a mitered hip functions and can be successfully constructed. 



Matt Millen

Matt Millen is a past president of the National Slate Association and a member of its Manual Committee and has been active in other roofing industry organizations. He has written articles for *Interface* and gives presentations at RCI events. Matt is a fifth generation roofing contractor based in Milwaukee, WI. He provides advice to other professionals on steep roofing issues. He may be contacted at [matt@millenroofing.com](mailto:matt@millenroofing.com).

