

Case Study: Slate Roof Repair

Selective slate replacement and flashing repairs enabled the First Presbyterian Church of Baldwinsville to extend the life of its existing slate roof and preserve an important architectural feature.

Anyone who has admired a slate roof on a house of worship can appreciate its beauty and character-defining qualities. But maintaining, repairing, and restoring slate roofs can often confuse congregations who therefore avoid taking any action, only to let the roof fall into disrepair.

Used in America as early as the 17th century, slate was highly popular from the mid-19th century through the 1920s when prominent roof lines and picturesque silhouettes were fashionable. In Preservation Briefs 29: The Repair, Replacement, and Maintenance of Historic Slate Roofs, Jeffrey S. Levine describes slate as "one of the most aesthetically pleasing and durable" roofing materials, lasting 60 to 125 years or longer with little maintenance if properly installed. Geologically, slate is a fine-grained metamorphic rock that splits easily into thin layers. It is ideal for roofing due to its high strength, low porosity, and low moisture absorption, and has the advantage of fire resistance. The life-span of a slate roof depends on the quality of materials (slates, nails, flashing, and other items) and installation methods, as well as environmental conditions and maintenance.

Like many churches of the mid-19th century, the First Presbyterian Church of Baldwinsville in Central New York (Horatio Nelson White, 1865) is a High Victorian Gothic-style building with a prominent roof patterned with green and purple Vermont slate. And like many congregations, the maintenance of the roof was done on an as-needed basis. "Over the years the church maintained the roof by replacing individual slates that were damaged during winter," says Carol Hovey, a member of the Buildings and Grounds Committee. Finally, in 1988 the congregation retained the Syracuse-based architectural firm of Crawford & Stearns to survey the entire building. At that time, the roof was examined and deteriorated roof flashings and foundation problems were identified. Working with the architects, the church first focused its efforts on correcting the foundation drainage problems.

Being aware of the roof conditions put the congregation on guard about leaks. "Two years ago we noticed an accelerating problem with roof leaks," says Ms. Hovey. The Church once again engaged Crawford & Stearns to conduct a more detailed inspection and develop architectural specifications for roof repairs which were completed by a local slate roofer. The work did not call for the complete replacement of the roof, but rather the installation of new lead-coated copper flashings, valleys, ice shields, and valley aprons, which required removal and reuse of adjacent slate courses. The architects specified installation details such as seam types, step and counter flashing, fasteners, 30 pound roofing felt, and red rosin paper. Vermont weathering green and unfading purple slates were identified as the correct match for the limited amount of replacement slate required. The roof survey allowed the congregation to ensure that the roof problems were properly identified and repairs were appropriately specified and corrected.

As part of any slate roof repair project, be aware that unsound wooden decking may be uncovered during the project and will need to be replaced; the wood decking actually supports and holds the slates in place. New wood should match adjacent wood and be back primed before installation. At First Presbyterian, in addition to roof decking repairs, carpentry work included repair and painting of the entire wooden cornice. For under \$40,000, the church was able to complete slate, sheet metal, and roof decking repairs, and repair and paint its wood cornice. A grant of \$3,500 from the Landmarks Conservancy's Sacred Sites Program helped fund the work.

As with any type of roof, it is important to check the surrounding flashing as a source of water infiltration. "Flashings are usually the leaking culprit in a slate roof, not the slate," preservation architect Ted Bartlett of Crawford & Stearns explains. The most common locations for leakage are at valleys and abutments, where roof planes intersect. Lead-coated copper and copper, traditionally used for these flashings, may show signs of corrosion -- small brown pits and pinholes -- in 50 to 60 years, long before most slate has worn out. Even the smallest pinhole can result in water penetration, and when flashing has corroded, it must be replaced.

The complete slate roof replacement at Christ Church in Binghamton included the installation of new slates, flashings, and selective wood decking. Ken M. Lustbader, Director of the Sacred Sites Program (far right), with architect Ted Bartlett of Crawford & Stearns Architects (second from left) and Carol Hovey and Allen Winegard of the First Presbyterian Church of Baldwinsville. Corroded metal sheathing on this open valley at the First Presbyterian Church of Baldwinsville was replaced with lead-coated copper.

Terne-coated stainless steel is ideal for valley flashings, providing longer protection than copper. "Even after the terne has worn off, the stainless steel won't corrode," notes architectural conservator Richard Pieper of Jan Hird Pokorny Architects & Planners, New York, NY. "It should be used more often." More flexible copper is needed, however, to conform to difficult, rounded shapes. Slate Roofing, a contractor's guide, points out that a second major category of slate roof failures --- missing, slipped, and loose slates -- arises from improper punching of nail holes or nailing methods, or from the use of iron nails that rust. In some cases, new nail holes can be punched and sound slates relaid. Copper or galvanized nails or clips should be used. Cracked slates are often caused by impact from fallen branches or other debris, or by people walking on the slates. Ice dams at gutters can also dislodge slates. Individual slates can be replaced inexpensively, secured by metal hooks, clips, and straps, or with the nail head covered by a narrow copper bib, as recommended by the National Slate Association.

Whereas the majority of the slates at the First Presbyterian Church were sound so that sheet metal repairs and limited slate replacement were sufficient, an increasing number of historic slate roofs need complete replacement. Aging slate delaminates (peels in layers), leading to increased water retention. If delamination is extensive, plan to replace large areas or the entire roof in a few years. Porous slates that remain damp several days after a rain should also be monitored, as the underlying decking and timbers can rot from the moisture.

The congregation of Christ Church in Binghamton (Richard Upjohn, 1853) opted for a \$200,000 roof replacement in 1996 when its 142-year-old slate roof was delaminating and cracking extensively. A 1987 report by Mr. Pieper had analyzed the problem of

the roof, perimeter drainage system, and related masonry deterioration. The first priority was the aging roof which was leaking around the dormers. The congregation decided that it would be financially prudent and aesthetically pleasing to replace the entire roof all at one time. A parishioner, Binghamton architect John Knudson of Bearsch Compeau Knudson, acted as engineering consultant in specifying and contracting with Midstate Industries; the Property Manager of the church, Bernard Frye, provided day-to-day supervision. Says Mr. Frye, "the elaborate pattern of rectangular, diamond-shaped, and octagonal slates in several colors was replicated with new Vermont slate from the same source as the original."

Green, red, purple, and mottled slates produced in New York and Vermont are widespread among religious properties in New York State, and fortunately are among the longest lasting domestic slates. Other common colors are grey, blue-black, and black, produced in Pennsylvania, Maine, and Virginia. Imported slate was also used historically. Since the cost of materials is relatively small compared to the labor of installation, it is most economical over the long term to use only the highest quality replacement slate, certified as S1, with an expected service life of 75 years or more. Check lead times with suppliers of matching slate, ideally from the same quarry or quarry region as the original slate, before scheduling a project. Artificial mineral fiber slate is not recommended for restoration work because of its unnatural appearance and shorter life span.

Awareness of existing conditions on a historic slate roof can help congregations plan ahead for repairs before roof leaks cause interior or structural damage. Fortunately, congregations can obtain excellent guidance on the history of slate roofing, repair methods, and replacement techniques from a number of publications.

Slate Roof Maintenance Tips

1. Document existing conditions and detailing (size, shape, color, texture, exposure, and coursing) with written, visual, and physical evidence.
2. Clean gutters during the fall and spring.
3. Keep foot traffic off the roof.
4. Inspect the roof annually and after severe storms, using binoculars from the ground, accessible openings, or, if possible, a boom-lift. Also inspect the roof from the interior including the attic.
5. Schedule a detailed inspection by a preservation architect or qualified slate roofer every four or five years. Seek professional help to determine the cause of leaks and specify appropriate repairs.
6. Broken, cracked, and missing slates should be repaired promptly by an experienced slater.
7. Do not patch slate roofs with asphaltic roofing compound. It soon cracks and permits water penetration as well as corrodes sheet metal.
8. Maintain files of historic photographs, drawings, inspection and repair records, and material samples.
9. In emergencies, heavy tarpaulins can be used as temporary roof coverings. Roll roofing and plywood sheathing can be used for longer protection while repairs are being planned.