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SLATE: A Historic and Repair Profile

In a recent survey of over 700 religious buildings in Philadelphia, it was found that a large majority was built with slate roofs, many of them highly ornamental and featuring multicolored or patterned shingles. This body of churches and synagogues, representative of many thousands more in other urban areas, is also vulnerable to roof deterioration—the maintenance problem most frequently encountered by old buildings of all kinds. Thus, no matter how decorative and durable a slate roof may be it remains a highly vulnerable element of the building.

Many of Philadelphia's historic churches and synagogues are 80 to 100 years old or more and still possess their original slate roofs. These roofs are approaching the limit of their serviceable lives. Clearly, then, the topic of slate roofs is an extremely important one to all those interested in conserving America's historic religious properties. Given the urgency, associated with a leaking roof and the high initial cost of replacing a slate roof in kind, now is the time to begin thinking about such actions. This will allow for an informed and rational decision-making process and give time for sufficient fund-raising to provide for high quality materials and workmanship.

Slate is the most durable roofing material available today. Moreover, the quality and variety of its textures, shapes and colors lend to it richness that no other roofing material can claim. Installed properly, slate roofs require little maintenance and will last 60 to 175 years or longer depending on where the slate was quarried. In Stratford-on Avon, Wiltshire, England, there is a Saxon chapel built during the 8th century which has one of the oldest slate roofs known and which is still in fine condition. The still sharp lines of inscriptions and carvings on slate tombstones at Quincy, Massachusetts and eastern Long Island, New York dating from the 1730's are a testimony to the durability of American slate.

Although slate quarrying was not common in this country until the latter half of the 19th century, slate roofing is known to have been used in the colonies prior to the Revolution. In fact, 17th century building ordinances of New York and Boston specifying fireproof construction recommended the use of slate or tile roofs. In the colony's early years, most slate used was imported from North Wales, but by 1876, imports of roofing slate had all but dried up and the United States had become a net exporter of roofing slate. The U.S. roofing slate industry reached its highest point in terms of both production and value in the period from 1897 to 1914. There were over 200 quarry operators in 13 states in 1899, Pennsylvania historically being the largest producer of all. In 1915, production fell below 1 million squares (at 100 square feet per square) and since that time there has been a steady downward trend.

The great decline in the use of roofing slate resulted from competition with substitute synthetic roofing materials such as asphalt shingles, which could be mass-produced, transported and installed at a lower cost than slate. Only recently, with the increasing popularity of historic preservation and the recognition of slate's superiority over other roofing materials, has slate begun to be the material of choice once again.

Slate is a fine-grained, crystalline rock formed from sediments of clay and sand, and transformed under intense heat and pressure over many millions of years. It is characterized by a perfect cleavage allowing it to be split along parallel planes into thin slabs, being thus adaptable to various commercial uses. The durability of a slate roof depends chiefly on three factors: the physical and chemical properties of the slate itself; the methods used in quarrying the slate; and the proper installation of the slate on the roof.

Variations in local chemistry and conditions under which the slate was formed have produced a wide range of colors and qualities. Slates vary greatly in color--from black and various shades of gray to greens, reds and purples of different hues--with no two slates exactly alike. Color, however, is no indication of quality.

Ribbons are dark streaky areas that are remnants of the original bedding planes of the sediments from which the slate is derived. When present, ribbons are visible on the cleavage face of slate. Upon exposure these ribbons turn a brownish color and deteriorate more rapidly than clear, unblemished areas. As a result, ribboned roofing slate is no longer manufactured. Since ribbon slate was less expensive than clear slate in years past, much streaky slate quarried in Pennsylvania can still be seen on the roofs of buildings in Philadelphia and the surrounding area.

It is difficult to assess the procedures by which a piece of roofing slate is manufactured without visiting the quarry and observing the process first hand. Some things can be looked for, however, in a shipment of roofing slate. An allowance for breakage of 10 percent in shipment is common. Anything more than this indicate either inferior slate or poor handling techniques at the quarry. A large-percentage of slates with chipped or broken corners is unacceptable. Each piece of slate should have a slight, almost imperceptible, arc to it. If viewed lengthwise, with the beveled surface (the surface to be exposed to the weather) facing up, this arc should form a convex surface. Finally, roofing slates should always be trimmed with their long sides parallel to the grain. The grain of a piece of roofing slate shows itself as an obscure striation of the cleavage surface (it also happens to be a secondary plane along which the slate may be readily split with a chisel).

Assuming that the slate obtained is of good quality and was quarried and manufactured properly, the next thing to consider is the methods by which it is installed. Installation is perhaps the most important factor contributing to the durability of a slate roof and the factor over which the owner has the most control.

In the laying of any roof, workmanship is as essential as the proper selection of material, and the more enduring the material, the more important does this factor become. As will be seen below, it is a mistake to assume that a roofer experienced in laying asphalt or some other type of roofing material is qualified to properly lay slate. Slating is more an art than a trade. The ability to lay slate properly so as to produce a watertight and aesthetically pleasing roof requires a certain innate skill and much practice. The goal here is to aid the reader in safeguarding against poor workmanship and improper selection of materials.

Clear roof expanses can be roofed by an experienced Slater and helper at the rate of about 2 or 3 squares per day (one square = 100 square feet). More complex roofs and/or the presence of such things as dormers, chimneys and valleys can bring this rate down to below 1 square per day. One square per day is a good average rate to use in figuring how long a job will take to complete. This takes into account the installation of flashings and gutters and the set-up and breakdown of scaffolding.

If a new slate roof is to be installed, it is advisable to remove the old roof first to prevent overloading of the roof timbers. This should be done in sections so as not to expose the entire sub-roof to the weather all at once. Once a section of the old roof is removed and the sheathing checked for rotten areas and projecting nails, 30 pound asphalt saturated roofing felt should be laid in horizontal courses with joints lapped at least 3 inches toward the eaves. The felt should be secured with galvanized roofing nails tacked through tin disks, called buttons. This will prevent wind gusts from lifting the felt and tearing it at the nail heads.

Slate is laid in horizontal courses with a standard 3-inch headlap. Headlap is the amount by which a slate laps the slate two courses below. The headlap should be increased to 4 inches on roofs with a rise of from 4 to 8 inches per foot of horizontal run and may be reduced to 2 inches on mansard roofs or roofs with a slope of more than 20 inches per foot. The steeper the pitch of a roof, the longer the slate can be expected to last as water may run off faster and is less likely to be pulled under the slate by capillary action. Each course should break joints with the preceding one. That is to say, each slate should be centered over a joint in the course below. On roofs in which the slates are to be of random width, the overlapping slate should be jointed as near as possible to the center of the slate below and not less than 3 inches from any joint. When this procedure is neglected, it is possible for water to pass between the joints, through the nail holes and eventually cause the underlying felt to deteriorate and leaks to develop. Slates should project 2 inches at the eaves and I inch at the gable ends. In addition, a starter course, placed lengthwise and bevel down, should be laid at the eaves. The starter course is canted 1/4 inch by a wooden cant strip placed at its lower edge to allow succeeding courses to lay flat on the wood sheathing. Finally, 50 or 60 slates should be left with the owner to be used for future repair work.

Slate roof failures are often attributable to improper nailing of the slates or improper selection of nails. The nailing of slates differs from that of other roofing materials. Slate nails should not be driven home as in the case of asphalt or wood shingles. Rather, they should be set such that the slate is allowed to hang freely on the nail. Nails driven in too far will crack the slate and those left projecting above the surface of the slate will puncture the slate overlying it. Careful attention must be given to the size, shape and the material of the nail used as well. All slates should be secured with at least two nails and larger slates, 3/4 inches and thicker and 20inches or more in length should be secured with four nails. A slate roof is only as enduring as it’s weakest component. Nails made of ferrous metals will rust out long before the slate begins to deteriorate. For this reason, large-head, diamond point slaters nails made of solid copper should always be used. Exposed nails are not permissible and slates, which overlap metal flashings, should be nailed in such a way as to avoid puncturing the metal.

Flashings are perhaps-the weakest point in any roof. Given the permanence of slate, it is poor economy to use anything but the most durable of metals and the best workmanship in installing flashings. Copper is probably the best flashing material. It is extremely durable, easily worked and maintenance free. Copper also has a relatively low coefficient of expansion compared to other non-ferrous metals. Sixteen-ounce copper sheet is the minimum weight that should be used for flashings of any kind. A lighter-weight metal will not be able to endure the erosive action of dust and grit carried off the roof by rainwater. Tin and terne plates are less desirable flashing materials since they must be painted periodically. This can only reduce the life of the slate as painter’s trample on the roof in order to reach the metal. Lead flashings are durable, but have a tendency to creep and tear over time, especially on steep slopes. Once a metal is chosen for flashings, it is important to stick with it. Mixing of dissimilar metals can set up a galvanic reaction leading to the decomposition of the most electropositive metal.

Occasionally, individual slates are damaged. Fallen tree limbs, large hail balls or the weight of somebody walking on the slate, can cause this. Broken slates should be repaired promptly by an experienced slater. The broken slate is first removed, and a new slate, which should match the old slate in color, texture and shape, is next cut to size and slid into place. The new slate is held -in- position by one nail inserted through the vertical joint of the slates in the course above and approximately I inch below the tail of the slate two courses above. A piece of copper, roughly 3 inches in width and 8 inches in length, is then slid lengthwise under the new slate and over the nail so that extends a couple of inches under the tail of the slate two courses above. This will ensure proper lap throughout the exposed joint through which the nail was driven. The copper "bib," as it is called, should be bent in a concave shape and teeth formed along its edges before insertion in order to ensure its remaining in place. A slate repair can be effected in from 2 to 5 minutes.

A final note of caution, Beware of unscrupulous roof contractors who attempt to sell you a “cheaper” slate roof. These roofs are sheathed with the same natural Vermont, Virginia and Pennsylvania slate as commercial standard slate roofs. What differs is the method of installation. The “cheaper” slate roof requires less slate and while this may reduce the cost of the roof, it also substantially reduces the life of the roof. As mentioned above, standard slate roofs are laid with a 3-inch headlap. “Cheaper” slate roofs have no headlap as they effectively eliminate every other course of a standard slate roof, relying solely on a membrane laid beneath the slate for water tightness. No membrane will last as long as natural slate.

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