Slate Roofing and Grading in the New Millennium

By Brian Stearns, Alan Stearns and John Meyer

According to information available through the 1928 edition of the publication, *Slate Roofs*, the first recognized slate quarry in this country dates back to 1734. That quarry was located in the Peach Bottom District near the Pennsylvania-Maryland border. The roofing slate quarried from that region was said to have been of very high quality. The test for slate quality at that time was based on the knowledge of the quarry owner or mill supervisor and how the material had fared on actual projects. This Peach Bottom slate is still known to exist on the roofs of many structures, a testament to the grading system of the time.

By the mid-1800s, roofing slate was being quarried throughout the United States. Roofing slate production reached its apex in the early 1900s with 1.4 million squares produced in 1904 alone. By the early 1920s some slate roofs installed in the mid to late 1800s had begun to fail. There were probably many factors that contributed to these failures, ranging from the use of steel-cut nails, to poor quality tin flashings, to wood rot related to ice build-up at the eaves of some buildings. But in many cases the slate itself had failed. Still, the quarry owners were determining the "grade" of slate.

In the 1920s, the federal government initiated a broad-based program to create simplified standards for various industries. The National Slate Association was formed to create these standards. One of the issues was to create acceptable standards, specifically grading. The National Slate Association in their 1924 publication, *Slate Roofs*, wrote:

Grading

Practically all producers have their own trade names and "grades" for slate of "Textural" and "Graduated" roofs and the distinguishing features of each should be familiar to the architect or owner before specifying.

The National Slate Association has on file a complete list of registered trade names of the various trade names.

With respect to the characteristics of slate, which have their effect upon grading, Dr. Oliver Bowles, Mineral Technologist of the U.S. Bureau of Mines, says, in "The Characteristics of Slate" paper delivered before the American Society of Testing Materials, June, 1923:

> *"Slate is of medium hardness, very fine grained of low porosity, great strength, and consists essentially of insoluble and stable minerals that will withstand weathering for hundreds of years. Some slate in Pennsylvania contains ribbons which consist of narrow original beds usually containing carbon, and darker in color than the body. There is tendency for some ribbons to contain an excessive amount of the less resistant minerals and they should not appear on exposed surfaces."*

Some Pennsylvania slate contains ribbons and the output of some quarries in this district is divided into two classifications, known as "Clear" and "Ribbon."

The characteristics which are commonly accepted as affecting the appearance of the slate on the roof—namely the surface, straightness, condition of the corners and thicknesses are used to determine the "Classification" or so-called "Grade" into which the quarries divide their product.

Commercial Standard Means Properly Graded

The classification below applies only to slate less than 1/4" thickness for "Standard" roofs.

When specifying "commercial standard roofing slate," it is unnecessary to further cover the essential characteristics or grading points to be considered by slate inspectors in selecting and piling the slate in the storage yards at the quarries. The term "commercial standard" embodies certain grading standards which govern the selection of slates for shipment and are as much a part of the process of preparing the slate slabs for roofing purposes as the splitting or any other operation.

It is to be regretted that it is impracticable to have one standard for all parts of the country. It will be realized, however, that it is impossible, due to some slates containing ribbons while others are clear, some having a rough surface, and certain other distinguishing features which must be given consideration.

In the past many architects have thought it necessary to specify roofing slate by the name of a town or by designating directions from certain towns. That this is too restrictive and unnecessary is apparent when it is realized that any particular color or kind of slate veins may extend through an entire region.

A Number Two slate comes from the same bed as the Number One and is only so classified because of surface characteristics. A knot or knurl or rougher

texture on the surface of one slate or a tile split from the same slab does not change its mineral constituents. It is not a manufactured or artificial product which can be varied by formula or human avarice to cut down on any expensive ingredient.

Architects and others may rest assured that their specification of "Commercial Standard slates in accordance with the grading standards of the National Slate Association" will obtain all of the essential characteristics and quality as though they were to prescribe all the following details of grading standards used at the quarry.

In the previous excerpt, the writer describes slate grades by their physical appearance. This seemed to be the accepted standard for the industry until 1932. However, the grading standards were set by and watched over by The National Slate Associa - tion. No such association exists today.

The federal government, faced with having to reroof their own structures and roof many new structures, needed to create a basic specification for roofing slate. On July 26, 1932, the Federal Specification Board, under the direction of the Bureau of the Budget, approved a specification for roofing slate labeled SS-S-451. This test SS-S-451 was apparently the blueprint for the ASTM test C-406, which is the current standard for roofing slate.

When The National Slate Association did its most recent revision of *Slate Roofs* in 1928, it focused on the classification, "Commercial Standard Thickness" combined with the quarry inspectors' designation, "Number One" or "Number Two." Most importantly, they clarified that "This specification covers only one type, i.e., Commercial Standard Thickness."

Commercial Standard Thickness slate is very smooth, very uniform from piece to piece, and 3/16 of an inch thick. In 1932 when the Federal Specification Board approved specification SS-S-451, they had adopted A, B, and C "Grades," but did not mention "Number Ones" or "Number Twos." Neither Slate Roofs nor SS-S-451 addressed thicker slate or slate that deviated from Commercial Standard in any way.

Then in the late 1950s, ASTM published ITS Designation: C-406 Standard Specification for Roofing Slate. In the ASTM specification, the classifications were changed from "Grades A, B, and C" to "Grades S1, S2, and S3" respectively. These "Grades" are determined by physical testing related to:

- Modulus of Rupture
- Water Absorption, and
- Depth of Softening.

Interestingly, the ASTM's physical requirements match identically those of the Federal Specification Board's requirements. The major difference is that the ASTM specification does not state that the tests are related specifically to "Commercial Standard Thickness Slate." Instead, they call out "Standard Roofs" (not standard slate) as "sloping roofs using a nominal thickness of 3/16" to 1/4". More importantly, physical testing is confused with physical appearance at this time. Prior to 1932, "grades" were determined by physical appearance. After 1932, grades were determined by physical testing. Grades A, B, and C were then renamed as S1, S2 and S3 in the 1950s ASTM classification.

When examining the classification and grading standards that have evolved for roofing slate, there are some serious flaws and/or assumptions.

Commercial Standard Roofing Slate as defined by the National Slate Association back in the 1920s was essentially perfect material. These shingles were smooth, a uniform thickness of 3/16", free of knots and knurls, and having no curvature. They were sorted at the quarries by the quarry inspectors and designated "Number Ones." This is the material on which the Federal Specification Board based its test and specifications. Later, ASTM dropped the words "Commercial Standard Thickness" from its specification and included "Standard Roofs (nominal thickness 3/16" to 1/4")," "Textural Roofs (various sizes, thicknesses, textures)," and "Graduated Roofs (greater range of sizes, thicknesses, and exposed lengths)."

Based on the discussion above about "Number Ones and Number Twos," is it possible that tests were performed on the perfect "Number One" slates and the results were accepted as satisfactory for "Number Twos" that came from the same bed? Were Number Twos tested differently or tested at all?

The standard governing the slate roofing industry appears to be based on physical requirements for perfect material of 3/16" thickness. Yet the only acceptable standard available today seems to have missed this point. Since ASTM eliminated the words "Commercial Standard Thickness," it must be questioned whether or not the formulas for these physical properties are correct to begin with, and if so, do thickness and surface texture affect them?

The importance of this discussion is multifaceted. Some of the new roofing slate coming from otherwise historically good quarries is not passing the ASTM tests. And multiple tests performed on the same piece of slate produce conflicting results. Does that mean that after 75-100 years of production of "Good" material that the slate being produced today is no longer "Good?"

Test results on imported slates raise the same issues. We have seen failures of some imported slate while others are still performing well. Are these the proper physical tests for all roofing slates regardless of thickness and texture? Who is responsible for quality control? Are the tests flawed, or are we looking at a realistic standard? These are all common questions. The most common question seems to be, "To whom do we turn to get the proper answers?" The National Slate Association no longer exists. In a litigation setting, who determines whether slate is good or bad? Do we rely on the quarry owner's word, or do we call on ASTM to explain the relevance of its test? Can anyone out there prove that the slate being produced (both in this country and in other countries) is good or bad? If the slate being tested passes the ASTM test as Grade S1, does that mean that it will last 75-100 years? Which organization or association will take the place of the National Slate Association?

There are only two times that any of this becomes an issue. The first is when slate is being purchased for a new roof. The second is when there is a failure. How does anyone evaluate slate in either of these two situations? They can use physical tests, or they can go by a quarry owner's word.

The problem is not the obvious canyon between the options but rather that there is not common industry knowledge to bridge the gap. If there is a problem with an EPDM roof, there are hundreds of sources and opinions to solicit for information.

That knowledge base does not exist for slate. Most observers know only enough to read test results. People being asked to evaluate a slate roof do not know what a "Good" piece of slate looks and sounds like. Compound this with the quarry owners' age-old system of grading by appearance and ASTM testing of physical properties, and it is no wonder that people are frustrated with the slate industry.

The Roof Consultants Institute has an opportunity to create a task group to review and resolve this issue. As engineers and/or members of RCI, this is a great opportunity to resolve a major problem within today's slate roofing industry. ■

Additional References

The Slate Book, available from RCI, 205 pages; $69.95 (members), $79.95 (non-members), plus S & H.

Preservation Brief, available from the U.S. Superintendent of Documents, "Repair, Replacement and Maintenance of Historic Slate Roofs," 16 pages; ISSN 00885-7016.

NRCA Steep Slope Manual, available from the National Roofing Contractors Association.

Slate Roofs, The National Slate Association, 1928, available from Vermont Structural Slate Company, Fair Haven, VT.

The Origin of "Slate"

The word "slate" comes from Old English "slat" or "sclat," borrowed from the French verb, "escalater" (now "eclater"), meaning "to split" or "to shiver to pieces."

About the Authors

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Brian Stearns, Alan Stearns and **John Meyer** are the authors of *The Slate Book.* They have worked nationally on slate projects from high profile New York City to remote Montana. Their skills and reputation for quality work have earned them a position on the National Historic Registry's list of qualified contractors. They have been invited to give demonstrations nationwide on the proper way to install a slate roof, and have done so for years at the RCI convention. The authors are currently employed by Vermont Slate & Copper Services, Inc. of Stowe, Vermont, a manufacturer and distributor of Alpine SnowGuards and other slate roof related products. They are members of The National Roofing Contractors Association, Northeast Roofing Contractors Association, Roof Consultants Institute, National Trust for Historic Preservation, and Construction Specifications Institute.