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White Paper

July, 2016

The Wind at Our Backs...
North American Produced Natural Roofing Slate Is There To Stay

With global weather disturbances becoming more frequent, designers, architects, contractors, code authorities and building owners are placing an ever increasing focus on a roofing product's capability of withstanding high winds. The attention took root in South Florida after Hurricane Andrew in 1994, but is now being cited for projects far outside the Sunshine State. We believe this trend will continue to evolve into more geographic regions and with even higher wind resistance requirements. The Material Standards Committee of the National Slate Association recently conducted wind resistance testing to confirm natural roofing slate's ability to withstand the elevated wind speeds that the market is now seeking.

Wind is directed by the test apparatus horizontally into the panel with the target area being the third course up from the bottom of the panel at a distance of 7 inches.

ASTM D3161/D3161M-15 Standard Test Method for Wind-Resistance of Steep Slope Roofing Products (Fan Induced-Method) is the broad, industry standard test method that applies to most discontinuous, air permeable, steep slope roofing products including natural slate. It is also the base test method applied by the 2015 FM Approvals Class Number 4475 for steep slope roof covers. The test method requires the assembly of two test panels (minimum 50" wide x 60" long) according to the manufacturer's installation instructions and mounted in the test stand at the minimum slope recommended by the manufacturer. Wind is directed by the test apparatus horizontally onto the panel with the target area being the third course up from the bottom at a distance of 7 inches. The test can be conducted at any one of three wind speeds, 60 mph for Product Class A, 90 mph for Product Class D and 110 mph for Product Class F. In the case of natural roofing slate, any cracking, breakage or blow off would constitute a failure under the test.

The installation methods and practices employed in our testing were the "minimums" taken from the National Slate Association's 2010 Design and Installation Manual. We chose to test at a common 8:12 slope with a 3 inch headlap. Our 5/8" plywood deck was covered with two layers of ASTM D226 Type II felt and a common size 18" x random width x 1/4-3/8" natural roofing slate was

The panels were "multi-colored", with a full range of semi-weathering and unfading slates being supplied by various National Slate Association member North American quarries.

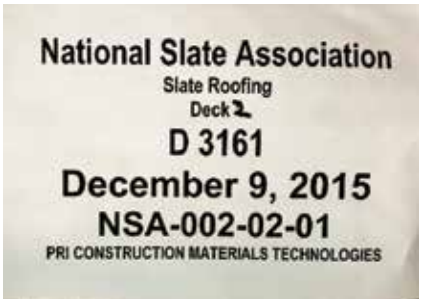
fastened to the roof deck using 1 ¾" long, smooth shank copper slating nails. The panels were "multi-colored", with a full range of semi-weathering and unfading slates being supplied by various National Slate Association member North American quarries. Having complete faith in the quality and physical properties of S-1 rated North American produced roofing slate, we chose to conduct the test at the maximum Class F 110 mph wind speed.

As one of the National Slate Association's recommended testing laboratories, and with their expertise in conducting wind testing on roofing as well as other construction materials, we chose PRI Construction Materials Technologies LLC of Tampa, Florida to perform our testing. With the skills of retired slate roofer Rich Nims, our two test panels were assembled and each was placed in turn into the test stand and subjected to 110 mph wind speeds for a period of two hours. At the completion of the two hour period, each panel was examined for any type of damage or blow off. The very uppermost course of slates that were only head nailed (unrestrained by an overlying slate and unsecured at the butt) sustained damage and blow off. This was expected and is not considered a failure under the test method. All remaining slates on both panels exhibited very little movement of any kind during the test, and none sustained any damage.

After successful completion of testing on both panels at 150 mph we increased the wind speed to the maximum 160 mph that the test apparatus was capable of producing for 10 minutes. Once again, with the exception of the upper unrestrained course, both panels remained intact and very stable throughout the wind speed increases and intervals to 160 mph. On examination after the test, both panels exhibited no damage, displacement or blow off of any kind.

With the successful conclusion of our ASTM D3161 wind resistance testing at 110 mph on each panel, we chose to increase the wind speed by 10 mph increments for 10 minute periods up to the maximum 150 mph as required under Section 4.1.1 of the 2015 FM Approvals Class Number 4475. This test procedure was designed by FM Approvals in order to establish an approved wind speed category for roof covers with a 20 mph safety factor. Hence, a 150 mph wind speed test would produce a rating of 130 mph under Section 4.1.1 of their standard. After successful completion of testing on both panels at 150 mph we increased the wind speed to the maximum 160 mph that the test apparatus was capable of producing for 10 minutes. Once again, with the exception of the upper unrestrained course, both panels remained intact and very stable throughout the wind speed increases and intervals to 160 mph. On examination after the test, both panels exhibited no damage, displacement or blow off of any kind.

The Saffir-Simpson Hurricane Wind Scale defines a Category 2 hurricane as having sustained wind speeds of up to 110 mph capable of "extensive damage." It defines a Category 5 (highest category) hurricane as having sustained wind speeds of 157 mph or greater and capable of "catastrophic damage."



PRI has issued a test report in the name of the National Slate Association dated December 8, 2015 verifying that the slate on our test panels met the requirements of a Class F (highest rated) roofing product under ASTM D3161/D3161M-15. The report also verifies our testing to 160 mph as having resulted in no damage. This testing information can be interpreted in the field by the reader as desired, but also might be submitted as a support document under the "Alternative Materials Section" (Section 104.11) of the Residential Building Code and International Building Code for consideration by local building code authorities. The PRI test report is available for downloading on our National Slate Association web site www.slateassociation.org along with a cover letter from the National Slate Association. The cover letter must be included with any distribution of the PRI report and no partial reproduction or distribution is permitted without the written approval of the National Slate Association.

It is our hope that PRI's wind resistance testing, supported by their report and conducted on behalf of the National Slate Association, can be referenced by our members where the resistance to wind is a consideration in the selection of roof coverings.

I would like to thank our quarry members for their generous donation of materials for the testing, and in particular, Matt Hicks of Evergreen Slate who co-ordinated the accumulation of all the slate, hand tools, nails, etc...and had them shipped to Tampa at Evergreen's expense. Matt also arranged for the very necessary skills of Richard the Roofer to build our test panels in Florida.

Natural slate proves once again...It is there to stay and always!

Contributed by David Large of North Country Slate who serves the NSA on the Material Standards Committee.

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March 31, 2016

This Cover Letter Must Be Included With Any Distribution Of The Five Page PRI Construction Materials Technologies LLC Report Attached, And Is Considered Part Of The Report By The National Slate Association. The Report (Including The Cover Letter) Must Be Reproduced In Full. No Partial Reproduction or Distribution Is Permitted Without The Written Approval Of The National Slate Association.

When referencing the report, please use the following citation: National Slate Association, "ASTM D3161/D3161M-15 Test Report," PRICMT Project No: NSA-002-02-01, Poultney, VT, December 8, 2015 (available at www.slateassociation.org).

ASTM D3161/D3161M-15 Test Report NSA-002-02-01 Standard Test Method for Wind-Resistance of Step Slope Roofing Products (Fan-Induced Method) dated December 8, 2015 is distributed by the National Slate Association for reference where the resistance to wind is a consideration in the selection of roof coverings.

The testing was conducted by PRI Construction Materials Technologies LLC of Tampa, Florida under contract to the National Slate Association, and was undertaken to independently establish the ability of North American produced, S-1 rated roofing slate to withstand elevated wind speeds without damage. Two panels were assembled with a representative range of colors from National Slate Association quarry members from the United States and Canada. Test panels were constructed to meet the *minimum requirements of the National Slate Association's 2010 printing of the *Slate Roofs-Design and Installation Manual*.

Under the ASTM D3161/D3161M-15 testing conducted by PRI Construction Materials Technologies LLC, 1/4" thick, S-1 rated, North American produced roofing slate met the requirements of the highest Class F (110 mph) roofing product. In addition, both panels withstood increased wind speeds of 120, 130, 140 and 150 mph for 10 minute intervals as required under Section 4.1.1 of FM Approvals Class Number 4475 for steep slope roof covers and then an additional increase to 160 mph, the maximum capability of the test equipment. The Saffir Simpson Hurricane Wind Scale considers a Category 5 hurricane as having wind speeds in excess of 157 mph. For questions related to this test report, please contact the National Slate Association toll free at 866-256-2111 or email mail@slateassociation.org.

**Isolated "sidelaps" were inadvertently spaced below the recommended 3 inches when assembling the test panels and the minimum of 2 inches was recorded by the laboratory technician in the PRI report. As this dimension would place the test panels at a disadvantage, the National Slate Association maintains the position that the testing is valid for the minimum installation recommendations of the 2010 Design and Installation Manual.*

CONSTRUCTION MATERIALS

TECHNOLOGIES

LABORATORY TEST RESULTS

Report for: National Slate Association
P.O. Box 172
Poultney, VT 05764

Attention: Mr. David Large

Product Name(s):	Nominal 1/4" Slate Shingles	**Manufacturer:**	Not provided
Date(s) Received:	*See Sampling Section*	**Source:**	*See Sampling Section*
PRI-CMT Project No.:	NSA-002-02-01	**Date(s) Tested:**	December 8, 2015

Purpose:

Determine wind resistance performance for the specified roof covering in accordance with **ASTM D 3161/D 3161M-15: *Standard Test Method for Wind-Resistance of Steep Slope Roofing Products (Fan-Induced Method)*** at a wind velocity of 110mph.

At the conclusion of the 110 mph test interval, the client requested the test to be extended by ramping up the air velocity in 10 mph increments to a maximum 160 mph.

Test Methods:

Testing was completed as described in ASTM D 3161-15 *Standard Test Method for Wind-Resistance of Steep Slope Roofing Products (Fan-Induced Method)*.

Testing was modified at the conclusion of the 2h sustained exposure of 110 mph. These additional air velocities were tested for a duration of 10 minutes each: 120 mph, 130 mph, 140 mph, 150 mph, and 160 mph.

Sampling:

Nominal 1/4" slate shingles were provided from the National Slate Association. Slates shingles were nominal 1/4" thick x 18" long x various widths. Widths of 9", 10", 11", and 12" were provided.

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Specimen Detail:

Roof Covering: The slates were installed using 0.134" x 1-3/4" copper nails placed in the premade holes of the slate. The premade holes 6" from the head of the shingle. The shingles were installed by leaving a 7-1/2" exposure and offsetting the vertical joints between adjacent courses a minimum of 2".

Underlayment: Two (2) layers of ASTM D 226 Type II roofing felt were installed with 12ga. 1-1/4" ring shank nails placed to hold the felt down, about 2" from the ends and 10" apart through the lap.

Deck: 5/8" APA Plywood nailed 6" o.c. at edges and 12" o.c. in field Joists installed 24" o.c.

Result: Testing was performed at 75±5°F and an 8:12 roof slope. Representative Test Photograph(s) are contained in Appendix B.

Property	Test Method	Results	Requirement
Wind Resistance [*Pass/Fail];* 110±5 mph for 2h; 75±5°F; Slope 8:12	ASTM D 3161		
Specimen 1	110 mph (Class F)	Pass	Restrains full shingle and tab from lifting; No evidence of permanent damage post-testing
Specimen 2	110 mph (Class F)	Pass	
Results of modified tested indicated below – duration for each interval was 10 minutes			
Specimen 1	120 mph	Pass	Restrains full shingle and tab from lifting; No evidence of permanent damage post-testing
Specimen 2	120 mph	Pass	
Specimen 1	130 mph	Pass	Restrains full shingle and tab from lifting; No evidence of permanent damage post-testing
Specimen 2	130 mph	Pass	
Specimen 1	140 mph	Pass	Restrains full shingle and tab from lifting; No evidence of permanent damage post-testing
Specimen 2	140 mph	Pass	
Specimen 1	150 mph	Pass	Restrains full shingle and tab from lifting; No evidence of permanent damage post-testing
Specimen 2	150 mph	Pass	
Specimen 1	160 mph	Pass	Restrains full shingle and tab from lifting; No evidence of permanent damage post-testing
Specimen 2	160 mph	Pass	

Statement of Compliance: The test specimens constructed and tested as described herein met the Class F requirements of ASTM D 3161-15: *Standard Test Method for Wind-Resistance of Steep Slope Roofing Products (Fan-Induced Method).*

Signed: _____

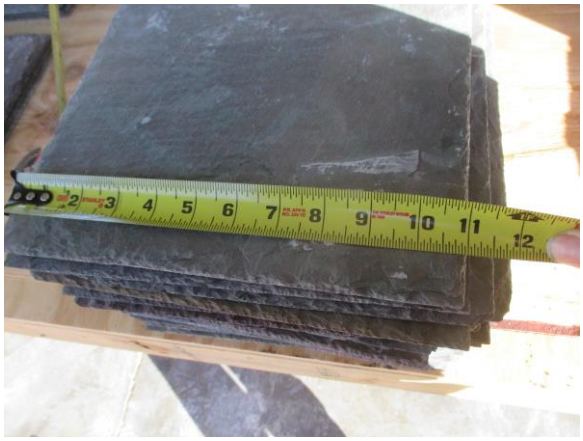
Zachary Priest, P.E.
Director

Report Issue History:

Issue #	Date	Pages	Revision Description (if applicable)
Original	01/12/2016	5	NA
Rev 1	01/13/2016	5	Updated sample information

APPENDIX FOLLOWS

Appendix A: Photographs of slates used in construction of the test specimens



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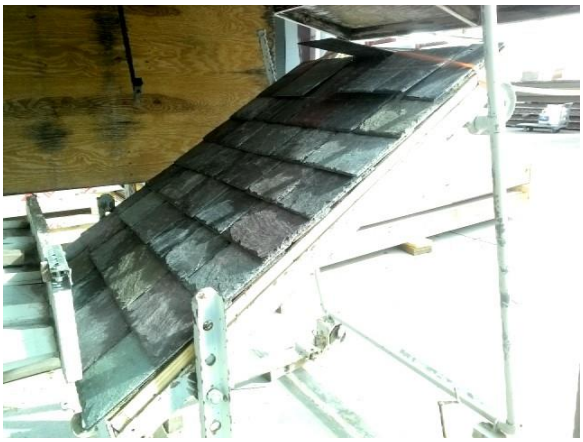
Appendix B: Representative Test Photographs (Note – the top row is not a representative course under study)

Deck #1 At Start of 110 mph

Deck #2 Before Start

Deck #1: End of 110 mph



Deck #2: End of 110 mph

Deck #1: At End of Testing (160 mph)

Deck #2: At End of Testing (160 mph)

END OF REPORT