Architectural Testing

FM 4473

TEST REPORT

Rendered to:

THE NATIONAL SLATE ASSOCIATION

PRODUCT TYPE: Natural Roofing Slates

Report No.:	**98120.01-801-75**
Test Dates:	**02/25/10**
Through:	**02/25/10**
Report Date:	**02/25/10**
Record Retention End Date:	**02/25/14**

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P.O. Box 172
Poultney, VT 05764

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Project Summary: Architectural Testing, Inc. was contracted by The National Slate Association to perform testing on natural roofing slates. The 1/4" thick slates met the performance requirements set forth in the referenced test procedures for a Class 3 rating, and the 3/8" thick slates a Class 4 rating. Test specimen descriptions and results are reported herein. The samples were provided by the client.

Test Procedures: The test specimens were evaluated in accordance with the following:

Specification Test Standard for Impact Resistance Testing of Rigid Roofing Materials by Impacting with Freezer Ice Balls, Class No. 4473, FM Approvals *(2005)*

Test Specimen Description:

Company Name: The National Slate Association

Series/Model: North American Natural Roofing Slate 6mm (1/4") thick

Product Type: Natural Roofing Slate

Individual Slate Size: 203 mm (8") width by 406 mm (16") height

Individual Slate Size (starter slate): 406 mm (16") width by 254 mm (10") height

Exposed Slate Size: 203 mm (8") width by 165 mm (6-1/2") height

Overall assembly size: 813 mm (32") width (first and third row from top) and 1016 mm (40") width (second and fourth row from top) by 902 mm (35-1/2") height

Number of slates: 4 wide (first and third row from top), 5 wide (second and fourth row from top), by 4 high

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Test Specimen Description: (Continued)

Average Nominal Thickness: 6 mm (1/4")

Color: Unfading green, unfading purple, unfading black

Finish: None

Deck Construction: The wood test deck was 36" wide x 36" high. The deck was constructed with 2" wide x 4" high lumber at the perimeter with one stud located at the midspan. Fastened to the top of the frame was a piece of 5/8" plywood. (Note: FM 4473 specifies 15/32" plywood deck)

Slate Description: The slates had a lightly textured front and back. The front had tapered edges. Two nail holes were located on the top of each slate. Both were 5" on center from the top edge, and 1-1/2" from each side edge. The starter slate had holes at 3" on center from the top edge, and 1-1/2" from each side edge.

Clips: No clips were utilized.

Installation: A 0.042" thick felt underlayment was fastened to the deck. One wooden cant strip measuring 1/4" thick x 1" wide was secured to the felt and plywood at 3" on center spacing from the bottom edge of the bottom row of slates. The cant strip was fastened with 1/8" x 1-1/2" copper nails, at 2" from batten ends and one at midpoint. The slates were placed over the felt in overlapped weatherboard fashion. Slates had a 9-1/2" overlap. Bottom slates were placed over a row of starter slate. Each slate was fastened to the deck through both nail holes with 1/8" x 1-1/2" copper nails.

Test Results: The following results have been recorded:

FM 4473, *Ice Ball Impact Resistance*

Sample Conditioning Temperature: 22°C (71°F) for at least 4 hours
Sample Conditioning Relative Humidity: 32% for at least 4 hours
Ice Ball Conditioning Temperature: -22°C (-8°F) for at least 48 hours
Muzzle Distance from Test Specimen: 914 mm (36")

Test Unit 1 (unfading green): Class 3

Impact #1: Missile Velocity: 31.06 m/s (101.9 fps); orientation 15° of vertical

Missile Weight: 44.9 g (0.0990 lbs)
Missile Diameter: 44.5 mm (1-3/4")
Kinetic Energy: 15.98 ft-lb
Impact Area: Bottom right corner, 2" from bottom
Observations: No visible cracking or breakage
Results: Pass

Impact #2: Missile Velocity: 30.60 m/s (100.4 fps); orientation 15° of vertical

Missile Weight: 44.9 g (0.0990 lbs)
Missile Diameter: 44.5 mm (1-3/4")
Kinetic Energy: 15.51 ft-lb
Impact Area: Bottom right corner, 2" from bottom
Observations: No visible cracking or breakage
Results: Pass

Impact #3: Missile Velocity: 30.85 m/s (101.2 fps); orientation 15° of vertical

Missile Weight: 42.9 g (0.0946 lbs)
Missile Diameter: 44.5 mm (1-3/4")
Kinetic Energy: 15.05 ft-lb
Impact Area: Left side, 2" from edge
Observations: No visible cracking or breakage
Results: Pass

Impact #4: Missile Velocity: 30.85 m/s (101.2 fps); orientation 15° of vertical

Missile Weight: 43.3 g (0.0955 lbs)
Missile Diameter: 44.5 mm (1-3/4")
Kinetic Energy: 15.11 ft-lb
Impact Area: Left side, 2" from edge
Observations: No visible cracking or breakage
Results: Pass

Test Results: (Continued)

Test Unit 2 (unfading purple): Class 3

Impact #1: Missile Velocity: 30.75 m/s (100.9 fps); orientation 15° of vertical

Missile Weight: 43.3 g (0.0955 lbs)
Missile Diameter: 44.5 mm (1-3/4")
Kinetic Energy: 15.11 ft-lb
Impact Area: Bottom right corner, 2" from bottom
Observations: No visible cracking or breakage
Results: Pass

Impact #2: Missile Velocity: 31.24 m/s (102.5 fps); orientation 15° of vertical

Missile Weight: 43.7 g (0.0963 lbs)
Missile Diameter: 44.5 mm (1-3/4")
Kinetic Energy: 15.73 ft-lb
Impact Area: Bottom right corner, 2" from bottom
Observations: No visible cracking or breakage
Results: Pass

Impact #3: Missile Velocity: 31.06 m/s (101.9 fps); orientation 15° of vertical

Missile Weight: 44.9 g (0.0990 lbs)
Missile Diameter: 44.5 mm (1-3/4")
Kinetic Energy: 15.98 ft-lb
Impact Area: Left side, 2" from edge
Observations: No visible cracking or breakage
Results: Pass

Impact #4: Missile Velocity: 30.91 m/s (101.4 fps); orientation 15° of vertical

Missile Weight: 42.8 g (0.0944 lbs)
Missile Diameter: 44.5 mm (1-3/4")
Kinetic Energy: 15.08 ft-lb
Impact Area: Left side, 2" from edge
Observations: No visible cracking or breakage
Results: Pass

Test Results: (Continued)

Test Unit 3 (unfading black): Class 3

Impact #1: Missile Velocity: 30.91 m/s (101.4 fps); orientation 15° of vertical

Missile Weight: 43.0 g (0.0948 lbs)
Missile Diameter: 44.5 mm (1-3/4")
Kinetic Energy: 15.15 ft-lb
Impact Area: Bottom right corner, 2" from bottom
Observations: No visible cracking or breakage
Results: Pass

Impact #2: Missile Velocity: 30.60 m/s (100.4 fps); orientation 15° of vertical

Missile Weight: 44.7 g (0.0985 lbs)
Missile Diameter: 44.5 mm (1-3/4")
Kinetic Energy: 15.44 ft-lb
Impact Area: Bottom right corner, 2" from bottom
Observations: No visible cracking or breakage
Results: Pass

Impact #3: Missile Velocity: 30.75 m/s (100.9 fps); orientation 15° of vertical

Missile Weight: 43.4 g (0.0957 lbs)
Missile Diameter: 44.5 mm (1-3/4")
Kinetic Energy: 15.14 ft-lb
Impact Area: Left side, 2" from edge
Observations: No visible cracking or breakage
Results: Pass

Impact #4: Missile Velocity: 30.91 m/s (101.4 fps); orientation 15° of vertical

Missile Weight: 43.3 g (0.0955 lbs)
Missile Diameter: 44.5 mm (1-3/4")
Kinetic Energy: 15.26 ft-lb
Impact Area: Left side, 2" from edge
Observations: No visible cracking or breakage
Results: Pass

Test Specimen Description:

Company Name: The National Slate Association

Series/Model: North American Natural Roofing Slate 10mm (3/8") thick

Product Type: Natural Roofing Slate

Individual Slate Size: 203 mm (8") width by 406 mm (16") height

Individual Slate Size (starter slate): 406 mm (16") width by 254 mm (10") height

Exposed Slate Size: 203 mm (8") width by 165 mm (6-1/2") height

Overall assembly size: 813 mm (32") width (second and fourth row from top) and 1016 mm (40") width (first, third, and fifth row from top) by 902 mm (35-1/2") height

Number of slates: 4 wide (second and fourth row from top), 5 wide (first, third, and fifth row from top), by 5 high

Average Nominal Thickness: 10 mm (3/8")

Color: Unfading black, semi-weathering gray/green, semi weathering strata gray

Finish: None

Deck Construction: The wood test deck was 36" wide x 36" high. The deck was constructed with 2" wide x 4" high lumber at the perimeter with one stud located at the midspan. Fastened to the top of the frame was a piece of 5/8" plywood. (Note: FM 4473 specifies 15/32" plywood deck)

Slate Description: The slates had a lightly textured front and back. The front had tapered edges. Two nail holes were located on the top of each slate. Both were 5" on center from the top edge, and 1-1/2" from each side edge. The starter slate had holes at 3" on center from the top edge, and 1-1/2" from each side edge.

Clips: No clips were utilized.

Installation: A 0.042" thick felt underlayment was fastened to the deck. One wooden cant strip measuring 1/4" thick x 1" wide was secured to the felt and plywood at 3" on center spacing from the bottom edge of the bottom row of slates. The cant strip was fastened with 1/8" x 1-1/2" copper nails, at 2" from cant strip ends and one at midpoint. The slates were placed over the felt in overlapped weatherboard fashion. Slates had a 9-1/2" overlap. Bottom slates were placed over a row of starter slate. Each Slate was fastened to the deck through both nail holes with 1/8" x 1-1/2" copper nails.

Test Results: The following results have been recorded:

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Sample Conditioning Temperature: 22°C (71°F) for at least 4 hours
Sample Conditioning Relative Humidity: 32% for at least 4 hours
Ice Ball Conditioning Temperature: -22°C (-8°F) for at least 48 hours
Muzzle Distance from Test Specimen: 914 mm (36")

Test Unit 1 (unfading black): Class 4

Impact #1: Missile Velocity: 34.81 m/s (114.2 fps); orientation 15° of vertical

Missile Weight: 64.0 g (0.1411 lbs)
Missile Diameter: 50.8 mm (2.0")
Kinetic Energy: 28.60 ft-lb
Impact Area: Bottom right corner, 2" from bottom
Observations: No visible cracking or breakage
Results: Pass

Impact #2: Missile Velocity: 34.75 m/s (114.0 fps); orientation 15° of vertical

Missile Weight: 66.1 g (0.1457 lbs)
Missile Diameter: 50.8 mm (2.0")
Kinetic Energy: 29.44 ft-lb
Impact Area: Bottom right corner, 2" from bottom
Observations: No visible cracking or breakage
Results: Pass

Impact #3: Missile Velocity: 33.89 m/s (111.2 fps); orientation 15° of vertical

Missile Weight: 63.5 g (0.1400 lbs)
Missile Diameter: 50.8 mm (2.0")
Kinetic Energy: 26.91 ft-lb
Impact Area: Left side, 2" from edge
Observations: No visible cracking or breakage
Results: Pass

Impact #4: Missile Velocity: 34.91 m/s (114.2 fps); orientation 15° of vertical

Missile Weight: 63.4 g (0.1398 lbs)
Missile Diameter: 50.8 mm (2.0")
Kinetic Energy: 28.33 ft-lb
Impact Area: Left side, 2" from edge
Observations: No visible cracking or breakage
Results: Pass

Test Results: (Continued)

Test Unit 2 (semi-weathering gray/green): Class 4

Impact #1: Missile Velocity: 34.99 m/s (114.8 fps); orientation 15° of vertical

Missile Weight: 62.9 g (0.1387 lbs)
Missile Diameter: 50.8 mm (2.0")
Kinetic Energy: 28.40 ft-lb
Impact Area: Bottom right corner, 2" from bottom
Observations: No visible cracking or breakage
Results: Pass

Impact #2: Missile Velocity: 34.41 m/s (112.9 fps); orientation 15° of vertical

Missile Weight: 66.8 g (0.1473 lbs)
Missile Diameter: 50.8 mm (2.0")
Kinetic Energy: 29.18 ft-lb
Impact Area: Bottom right corner, 2" from bottom
Observations: No visible cracking or breakage
Results: Pass

Impact #3: Missile Velocity: 33.83 m/s (111.0 fps); orientation 15° of vertical

Missile Weight: 64.0 g (0.1411 lbs)
Missile Diameter: 50.8 mm (2.0")
Kinetic Energy: 27.02 ft-lb
Impact Area: Left side, 2" from edge
Observations: No visible cracking or breakage
Results: Pass

Impact #4: Missile Velocity: 34.99 m/s (114.8 fps); orientation 15° of vertical

Missile Weight: 64.1 g (0.1413 lbs)
Missile Diameter: 50.8 mm (2.0")
Kinetic Energy: 28.95 ft-lb
Impact Area: Left side, 2" from edge
Observations: No visible cracking or breakage
Results: Pass

Test Results: (Continued)

Test Unit 3 (semi-weathering strata gray): Class 4

Impact #1: Missile Velocity: 34.99 m/s (114.8 fps); orientation 15° of vertical

Missile Weight: 63.0 g (0.1389 lbs)
Missile Diameter: 50.8 mm (2.0")
Kinetic Energy: 28.45 ft-lb
Impact Area: Bottom right corner, 2" from bottom
Observations: No visible cracking or breakage
Results: Pass

Impact #2: Missile Velocity: 34.81 m/s (114.2 fps); orientation 15° of vertical

Missile Weight: 64.0 g (0.1411 lbs)
Missile Diameter: 50.8 mm (2.0")
Kinetic Energy: 28.60 ft-lb
Impact Area: Bottom right corner, 2" from bottom
Observations: No visible cracking or breakage
Results: Pass

Impact #3: Missile Velocity: 34.81 m/s (114.2 fps); orientation 15° of vertical

Missile Weight: 63.2 g (0.1393 lbs)
Missile Diameter: 50.8 mm (2.0")
Kinetic Energy: 28.24 ft-lb
Impact Area: Left side, 2" from edge
Observations: No visible cracking or breakage
Results: Pass

Impact #4: Missile Velocity: 34.59 m/s (113.5 fps); orientation 15° of vertical

Missile Weight: 66.2 g (0.1459 lbs)
Missile Diameter: 50.8 mm (2.0")
Kinetic Energy: 29.22 ft-lb
Impact Area: Left side, 2" from edge
Observations: No visible cracking or breakage
Results: Pass

Test Equipment:

Cannon: Constructed from steel piping utilizing compressed air to propel the missile

Missile: 44.5 mm (1-3/4") and 50.8 mm (2.0") diameter ice balls

Timing Device: Electronic Beam Type

Timing Device Calibration Date: 9/18/09

List of Official Observers:

Name	Company
David Large	North Country Slate
Tom Klein	Architectural Testing, Inc.
Jesus Mata	Architectural Testing, Inc.

Data sheets, representative samples of test specimens, a copy of this report, or other pertinent project documentation will be retained by Architectural Testing, Inc. for a period of four years from the original test date. At the end of this retention period, such materials shall be discarded without notice and the service life of this report will expire.

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For ARCHITECTURAL TESTING, INC.

Digitally Signed by: Tom Klein

Tom Klein
Technician

Digitally Signed by: Andy Cost

Andy Cost
Laboratory Manager

TK:ac

Attachments (pages): This report is complete only when all attachments listed are included.

Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	02/25/10	N/A	Original Release