LABORATORY REPORT

AMT Laboratories • 3741 Greenway Circle • Lawrence, Kansas 66046 • (888) 376-3600

FOR: Glacier Stone Supply, LLC
955 Whitefish Stage Road
Kalispell, MT 59901

SUBJECT: Glacier Stone Supply, LLC
Kalispell, MT
Immersion, Taber Abrasion, and Modulus of Rupture Evaluation

DATE: June 3, 2009
PROJECT: 0904-06 IM TAB MRD

SAMPLES SUBMITTED: Various sizes of the below types of unpolished natural stone:

Sample
"Canyon Creek/Bitterroot/Glacier Mountain" gray and tan argillite
"Loon Lake" dark gray argillite
"Bighorn" red, tan, dark brown argillite
"Buckskin" tan sandstone

PURPOSE OF TEST:

- To determine the water absorption characteristics of the submitted stone using ASTM C 97.
- To determine the abrasion resistance characteristics of the submitted stone using ASTM C 1353.
- To determine the modulus of rupture characteristics of the submitted stone using ASTM C 99 for the submitted sandstone and ASTM C 120 for the submitted argillite.

TEST METHODS: ASTM C 97 Standard Test Method for Absorption of Dimension Stone (Modified)

Samples for the water absorption test were cut with a wet masonry saw into test specimen approximately 2" x 2" x 2". The samples were then rinsed under garden hose strength water pressure and were placed into a drying oven to obtain dry weights.

Water absorption values of the samples were determined by comparing the dry weight of the samples with their weight after immersion in water for 10-minute, 30-minute, 60-minute, 24-hour and 48-hour timed intervals.

The test was performed in triplicate on each type of stone to obtain an average.

TEST RESULTS: ASTM C 97 (Modified)

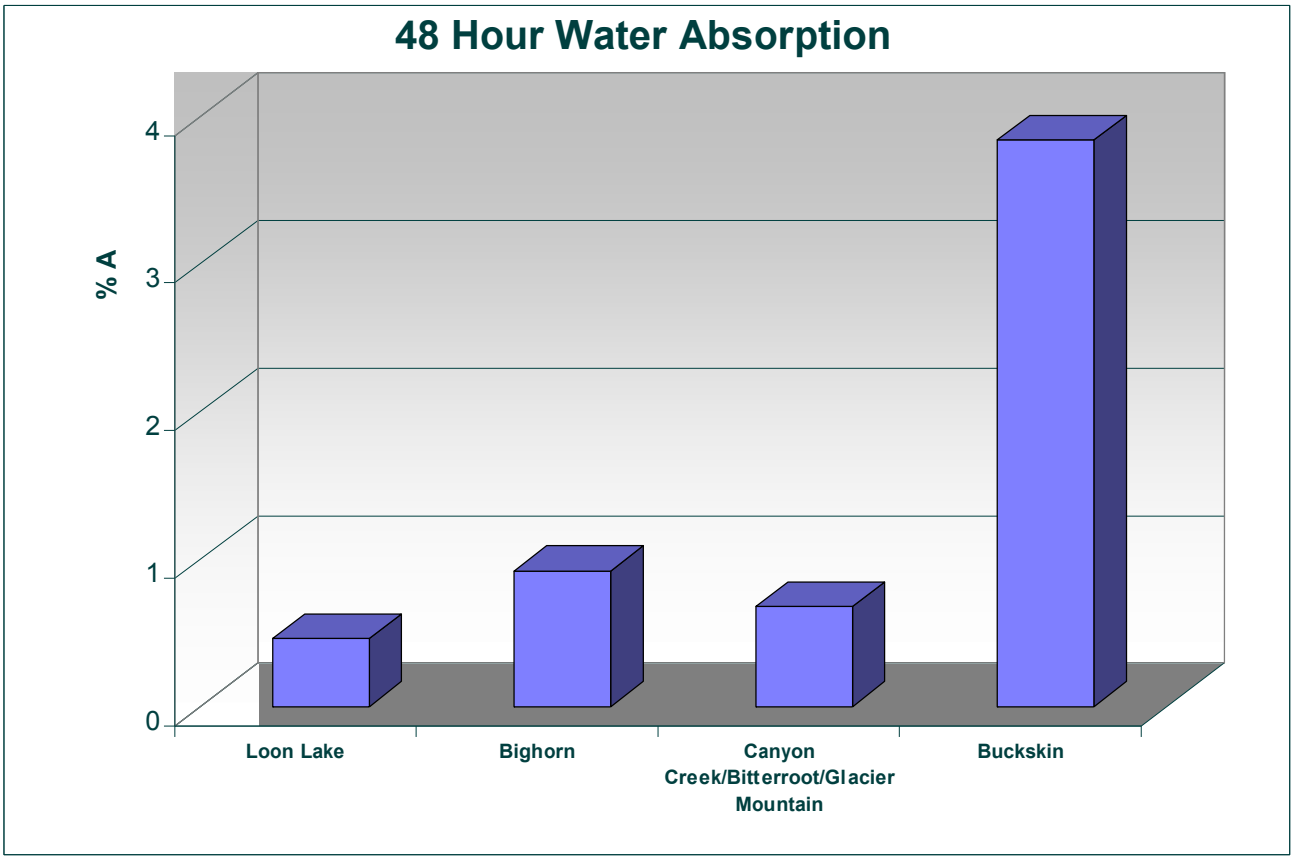
Submitted Samples

Sample	10 Min. % Weight	30 Min. % Weight	60 Min. % Weight	24 Hrs. % Weight	48 Hrs. % Weight
"Canyon Creek/Bitterroot/Glacier Mountain" argillite	0.26%	0.31%	0.35%	0.59%	0.68%
"Loon Lake" argillite	0.16%	0.20%	0.23%	0.28%	0.46%
"Bighorn" argillite	0.37%	0.41%	0.52%	0.83%	0.92%
"Buckskin" sandstone	1.58%	2.09%	2.57%	3.70%	3.84%

See Graph 1 on following page.

GRAPH: ASTM C 97 (Modified)

Submitted Stone



TEST METHODS: ASTM C 1353 Standard Test Method Using the Taber Abraser for Abrasion Resistance of Dimension Stone Subjected to Foot Traffic

This test method consists of mounting the test specimen onto a Taber Industries 5135 Abraser and subjecting the specimen to 1000 revolutions under H-22 Calibrade abrasive wheels loaded with 1000 gram weights.

The submitted stone were cut with a wet masonry saw into samples approximately 4" x 4" x 3/8". The test was to be performed in triplicate; however, some of the samples were deemed too rough to be used for the test (the test method requires a flat surface). Therefore, only one sample was able to be used for the test on the "Canyon Creek/Bitterroot/Glacier Mountain" and "Loon Lake" stone. Two samples were able to be used for the test on the "Bighorn" and "Buckskin" stone.

The test specimen were weighed to the nearest 0.01 grams before and after the test to determine the weight loss due to abrasion. The test was performed in laboratory conditions that were approximately 72° F and 34% humidity.

TEST RESULTS: ASTM C 1353

Sample	Pre Abrasion (g)	Post Abrasion (g)	Grams Lost	Average Grams Lost
"Canyon Creek/Bitterroot/Glacier Mountain" argillite	207.01	205.54	1.47	**1.47**
"Loon Lake" argillite	295.73	294.33	1.40	**1.40**
"Bighorn" argillite	478.52	465.48	13.04	**11.41**
"Bighorn" argillite	457.66	447.88	9.78	
"Buckskin" sandstone	290.04	276.90	13.14	**10.44**
"Buckskin" sandstone	305.57	297.84	7.73	

NOTE: The Index of Abrasion Resistance can be calculated as follows:

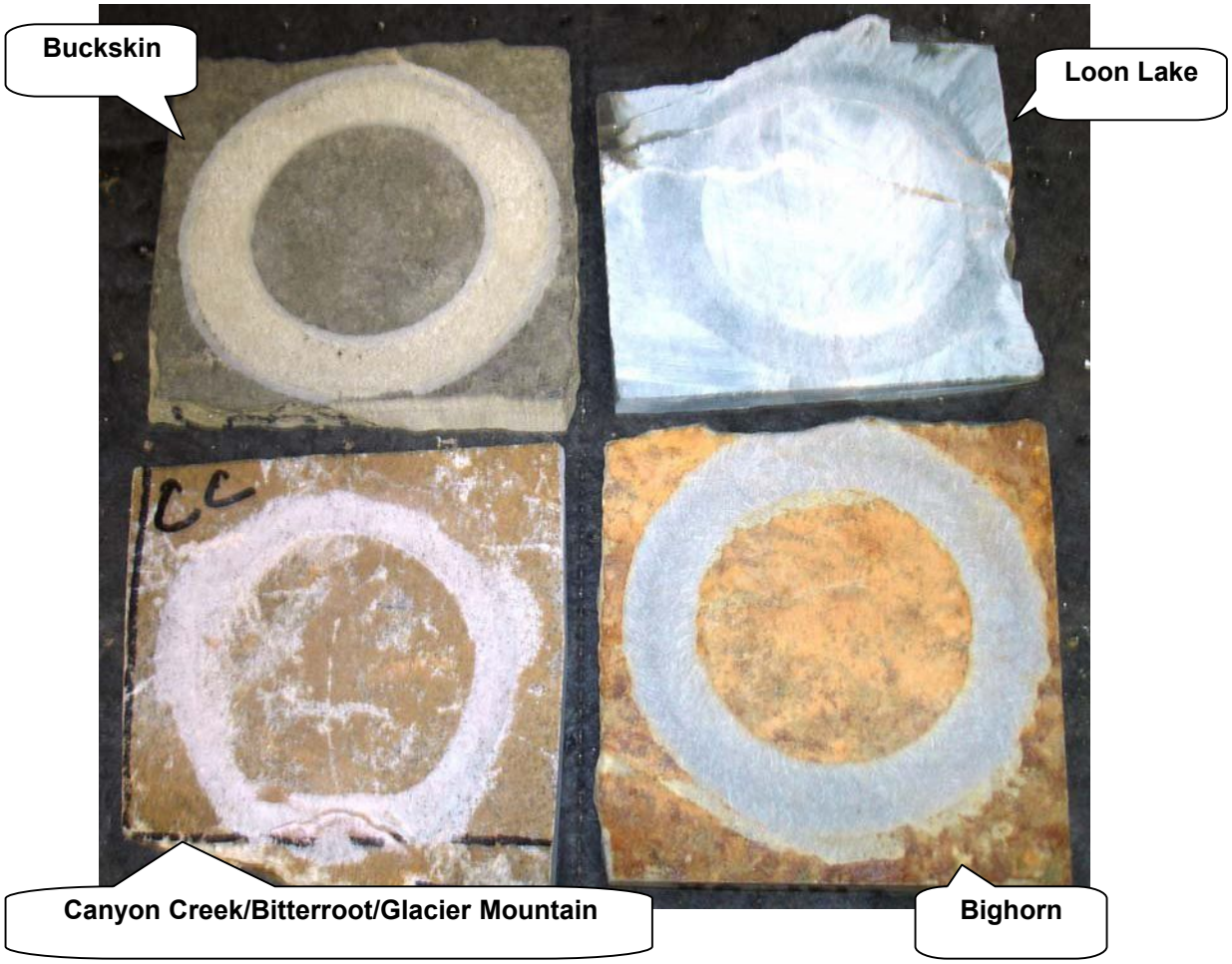
$$\text{Index of Abrasion Resistance} = \frac{36.75}{w_0 - w_1} \times p \times \frac{n}{1000}$$

where:
w_0 = initial weight of test specimen
w_1 = weight of test specimen after 1000 revolutions
p = bulk density
n = number of revolutions actually ran during test (in this case, 1000)

However, AMT Labs is not equipped with the apparatus used to determine the bulk density of the stone. This test could be performed at a later date using an outside lab if desired.

PHOTOGRAPH: ASTM C 1353

Submitted Samples after Abrasion Resistance Testing



TEST METHODS: ASTM C 99 Standard Test Method for Modulus of Rupture of Dimension Stone and ASTM C 120 Standard Test Method for Flexure Testing of Slate

Since argillite is a slate type stone, ASTM C 120 Standard Test Method for Flexure Testing of Slate was performed on the "Loon Lake", "Canyon Creek/Bitterroot/Glacier Mountain", and "Bighorn" argillite samples. ASTM C 99 was performed on the "Buckskin" sandstone samples.

These test methods consist of laying the test specimen on three supporting knife edges, spaced 7" apart, with all three knife edges parallel. A loading rate not exceeding 1000 lbf/min (4450 N/min) is applied until failure of the specimen occurs.

The argillite samples were tested where the load was applied across the grain. The rift direction was not clearly identified on the sandstone sample. Therefore, testing was performed in the orientation they were received based on the manner in which the samples were saw-cut.

The argillite samples were tested in a dry condition as per the test method. The sandstone samples were tested in a wet condition as requested by Glacier Stone Supply, LLC.

One sample of "Canyon Creek/Bitterroot/Glacier Mountain" and one sample of "Bighorn" were damaged during shipment and could not be tested.

TEST RESULTS: ASTM C 120

Sample	Test Orientation	Width (in.)	Thickness (in.)	Breaking Load (lb)	Modulus of Rupture (psi)
Loon Lake 1	Across the grain	1.59	1.29	1220	6960
Loon Lake 2		1.53	1.11	500	4010
Loon Lake 3		1.51	1.22	1060	7130
Loon Lake 4		1.57	1.57	600	2320
Loon Lake 5		1.59	0.84	400	5310
				Average Modulus of Rupture:	**5150**

Sample	Test Orientation	Width (in.)	Thickness (in.)	Breaking Load (lb)	Modulus of Rupture (psi)
Canyon Creek/Bitterroot/Glacier Mountain 1	Across the grain	1.51	0.91	380	4540
Canyon Creek/Bitterroot/Glacier Mountain 2		1.55	1.13	660	5010
Canyon Creek/Bitterroot/Glacier Mountain 3		1.41	1.39	820	4510
Canyon Creek/Bitterroot/Glacier Mountain 4		1.43	1.14	600	4830
				Average Modulus of Rupture:	**4720**

TEST RESULTS: ASTM C 120

Sample	Test Orientation	Width (in.)	Thickness (in.)	Breaking Load (lb)	Modulus of Rupture (psi)
Bighorn 1	Across the grain	1.53	1.05	320	2840
Bighorn 2		1.49	1.13	340	2680
Bighorn 3		1.58	1.06	620	5240
Bighorn 4		1.36	1.06	300	2960
				Average Modulus of Rupture:	**3430**

TEST RESULTS: ASTM C 99

Sample	Test Orientation	Cure Condition	Length of Span (in.)	Width (in.)	Thickness (in.)	Breaking Load (lb)	Modulus of Rupture (psi)
Buckskin 1	Perpendicular	Wet	7	3.48	2.36	1860	1010
Buckskin 2			7	3.54	2.24	3700	2180
Buckskin 3			7	3.41	2.40	5660	3030
Buckskin 4			7	3.52	2.27	2060	1190
Buckskin 5			7	3.51	2.40	2350	1220
						Average Modulus of Rupture	**1140**

NOTE: ASTM C 616 Standard Specification for Quartz-Based Dimension Stone requires a minimum modulus of rupture of 350 psi for sandstone, 1000 psi for quartzitic sandstone, and 2000 psi for quartzite. Therefore, the test results indicate the average modulus of rupture of the submitted “Buckskin” sandstone is above the minimum requirement per ASTM C 616.

Courtney A. Murdock
Project Testing Director

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ALL SAMPLES SUPPLIED FOR THE ABOVE EVALUATION WILL BE DISPOSED OF NINETY (90) DAYS AFTER THE ISSUE DATE OF THIS REPORT. IF SAMPLES ARE TO BE RETAINED FOR ADDITIONAL TESTING OR RETURNED TO THE SENDER, PROVIDE WRITTEN INSTRUCTIONS TO THE LABORATORY WITHIN NINETY (90) DAYS OF THE ISSUE DATE OF THIS REPORT.

Recommendations made within this report are based on laboratory test applications and observations. Final determination of the suitability of a product and/or procedure should be made only after thorough job testing on actual surfaces.