NATURAL STONE INSTITUTE

STONE LABORATORY TEST REPORT

Report No.: 23-0102.02-R0
Test Date(s): 09/12/23 – 02/02/23
Initial Report Date: 02/09/23
Retention Date: 02/02/28

Prepared for: Jacobs Stone Products, Inc.
1210 W. Pierce Street
San Saba, TX 76877

Product: Natural Sandstone Product – Texas Sandstone (Medium-Light Brown Tone)

Scope: The Natural Institute (NSI) was contracted by Jacobs Stone products, Inc. to perform physical properties evaluations for one natural sandstone product (Texas Sandstone). The scope of testing included absorption, density, compressive strength, modulus of rupture, abrasion resistance, flexural strength, and freeze-thaw durability. All testing was performed at the NSI laboratory located in Oberlin, Ohio.

Methods: The products were evaluated in accordance with the following test method(s):

ASTM C615/C615M-22, *Standard Specification for Quartz-Based Dimension Stone*

ASTM C97/C97M-18, *Standard Test Method for Absorption and Bulk Specific Gravity of Dimension Stone*

ASTM C170/C170M-17, *Standard Test Method for Compressive Strength of Dimension Stone*

ASTM C99/C99M-18*, Standard Test Method for Modulus of Rupture of Dimension Stone*

ASTM C1353/C1353M-20e1, *Standard Test Method for Abrasion Resistance of Dimension Stone Subjected to Foot Traffic Using a Rotary Platform Abraser*

ASTM C880/C880M-18e1, *Standard Test Method for Flexural Strength of Dimension Stone*

ASTM C666/C666M-15, *Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing*

Test Materials: Test materials were provided by Jacobs Stone products, Inc. on 09/08/23 and 01/02/24, designated as Texas Sandstone, and were received in good condition for testing. Specimens were tested as received other than preconditioning as required by the applicable test method(s) prior to testing. Representative test materials shall be retained by the NSI for a period of four years.

Test Witness Record

Name	Company
Clint Eads	NSI
Roger Lawson	NSI
Scott D. Scallorn	NSI

Test Procedure(s): Unless otherwise stated, all specimen conditioning and testing was conducted in standard laboratory conditions. Test photos are located on pages 19-22 of this report. Equipment calibration certificates are available upon request.

ASTM C97 – Absorption and Density Evaluation

The absorption and density evaluations were conducted in accordance with the procedures detailed in ASTM C97. The specimens were oven-dried at 60°C to a stable mass condition (minimum 48 hours), reacclimated to ambient lab temperature and weighed on an Ohaus digital balance (ICN: NSI00022) for determination of dry condition mass. They were then immersed in filtered water for 48 hours prior to individual removal, surface drying with a damp cloth and determination of wet condition mass. The specimens were then suspended in the water within a wire cage and weighed for determination of immersed condition mass. Absorption (%) and bulk specific gravity were calculated for each specimen as per the equations in ASTM C97, Section 9. Test results were averaged for the series and evaluated against the performance criteria presented in ASTM C616, Table 1.

ASTM C170 – Compressive Strength Evaluation

The compressive strength evaluation was conducted on a Test Mark compression tester (ICN: NSI00001) in accordance with the procedures detailed in ASTM C170. Pretest specimen dimensions were measured with a 6" x 0.0005" Digital Caliper (ICN: NSI00008). Specimens were tested in both oven-dry and wet conditions. Dry condition specimens were oven-dried at 60°C for a minimum of 48 hours and cooled to ambient prior to testing. Wet condition specimens were immersed in water for 48 hours prior to individual removal and testing. Compressive strength was calculated for each specimen as per the equation in ASTM C170, Section 10.1. Test results were averaged for the series and evaluated against the performance criteria presented in ASTM C615, Table 1.

ASTM C666 – Freeze-Thaw Resistance

The freeze-thaw exposure cycling was conducted in modified ESPEC EPX-4H environmental conditioning chamber (ICN: NSI00015) in accordance with ASTM C666, Procedure B (Freeze-in-Air, Thaw-in-Water). The specimens were subjected to a total of 100 exposure cycles each consisting of lowering the temperature of wetted specimens from 40°F to 0°F in an air-surround condition and returning to 40°F in an immersed condition. Upon completion of each 25-cycle exposure increment, five specimens were removed from cycling and visually evaluated for breakage of other readily visible deleterious effects. The removed specimens were immersed in water for 48 hours prior to individual removal and testing in flexure as per ASTM C880 (detailed below).

ASTM C880 – Flexural Strength

The Flexural strength evaluation was conducted on an ATS Universal Test Machine (ICN: NSI00003) employing a 12.5-kip load cell (ICN: NSI00004) in accordance with the procedures detailed in ASTM C880. Pretest specimen dimensions were measured with a 6" x 0.0005" Digital Caliper (ICN: NSI00008). Control series (no exposure cycling) specimens were tested in both oven-dry and wet conditions. Post-exposure series specimens were tested after 25, 50, 75, and 100 cycle completion and in wet condition only. Dry condition specimens were oven-dried at 60°C for a minimum of 48 hours and cooled to ambient prior to testing. Wet condition specimens were immersed in water for 48 hours prior to individual removal and testing. Specimens were supported at a test span of 12.5 in. and loaded at quarter point (6.25 in. loading span) until failure. Flexural strength was calculated for each specimen as per the equation in ASTM C880, Section 10.1. Test results for both wet and dry condition control series were averaged for each test series and the post-exposure mean flexural strength of each test series was further evaluated against both the comparative zero-cycle wet condition control series and the preceding freeze-thaw exposure series for evaluation of potential strength loss.

ASTM C99 – Modulus of Rupture Evaluation

The Modulus of Rupture (MoR) evaluation was conducted on an ATS Universal Test Machine (ICN: NSI00003) employing a 12.5-kip load cell (ICN: NSI00004) in accordance with the procedures detailed in ASTM C99. Pretest specimen dimensions were measured with a 6" x 0.0005" Digital Caliper (ICN: NSI00008). Specimens were tested in both oven-dry and wet conditions. Dry condition specimens were oven-dried at 60°C for a minimum of 48 hours and cooled to ambient prior to testing. Wet condition specimens were immersed in water for 48 hours prior to individual removal and testing. Specimens were supported at a test span of 7.0 in. and loaded at midspan until failure. Flexural strength was calculated for each specimen as per the equation in ASTM C99, Section 11.1. Test results were averaged for the series and evaluated against the performance criteria presented in ASTM C615, Table 1.

ASTM C1353 – Abrasion Resistance Evaluation

The abrasion resistance evaluation was conducted in accordance with the procedures detailed in ASTM C1353. The specimens were oven-dried at 60°C for a minimum of 48 hours and cooled prior to determination of pre-abrasion mass on an Ohaus digital balance (ICN: NSI00022) The specimens were then evaluated on a Taber Industries rotary platform abraser (ICN: NSI00024) employing H-22 Calibrade abrasive wheels with 1,000 grams of downward force applied to each for a total of 1000 wear cycles. Upon completion of cycling, post-exposure mass was determined for each specimen. Employing the bulk specific gravity results obtained from ASTM C97 evaluation, Index of Abrasion was calculated for each specimen as per the equation in ASTM C1353, Section 9.1. Test results were averaged for the series and evaluated against the performance criteria presented in ASTM C615, Table 1.

Specimen Details

Test Method	Quantity	Nominal Dimensions	Description
ASTM C97	5	2.25 in. cubes	Medium-Light Brown Natural Sandstone Product
ASTM C170	20 Total Perpendicular, Wet: 5 Perpendicular, Dry: 5 Parallel, Wet: 5 Parallel, Dry: 5	2.25 in. cubes	
ASTM C99	20 Total Perpendicular, Wet: 5 Perpendicular, Dry: 5 Parallel, Wet: 5 Parallel, Dry: 5	4 in. x 8 in. x 2.25 in. thickness	
ASTM C1353	3	4 in. square x 0.375 in. thickness	
ASTM C880	20 Total Perpendicular, Wet: 5 Perpendicular, Dry: 5 Parallel, Wet: 5 Parallel, Dry: 5	4 in. x 15 in. x 1.25 in. thickness	
AS TM C666 (ASTM C880)	20 Total <u>Perpendicular:</u> 25 Cycle: 5 50 Cycle: 5 75 Cycle: 5 100 Cycle: 5	4 in. x 15 in. x 1.25 in. thickness	

Test Results

ASTM C97 – Absorption & Density Evaluation

Specimen No.	Measured Mass (g)			Absorption (%)	Bulk Specific Gravity	Density (lbs/ft^3)
	Oven-Dry	48-Hour Wetted	Immersed Suspended			
1	392.91	417.75	234.99	6.32	2.15	134.2
2	419.61	446.22	250.73	6.34	2.15	134.0
3	431.43	459.20	257.82	6.44	2.14	133.7
4	420.46	446.32	251.18	6.15	2.16	134.5
5	428.22	455.96	255.62	6.48	2.14	133.4
Series Average				**6.35**	**2.15**	**134.0**
Standard Deviation				0.13	0.01	0.43
Coefficient of Variation (%)				2.00	0.33	0.32

ASTM C1353 – Abrasion Resistance Evaluation

Specimen No.	Bulk Specific Gravity	Mass (g)			Wear Cycles Completed	Index of Abrasion
		Initial	End	Loss		
1	2.15	209.51	192.39	17.12	1,000	4.6
2		209.33	181.76	27.57		2.9
3		212.50	194.04	18.46		4.3
Series Average						**3.9**
Standard Deviation						0.9
Coefficient of Variation (%)						23.8

ASTM C170 – Compressive Strength Evaluation – Wet Condition, Perpendicular Loading

Specimen No.	Test Condition	Specimen Dimensions (in)		Loading Area (in^2)	Failure Load (lb_f)	Compressive Strength (psi)
		Length	Width			
PP-W-1	Loaded Perpendicular to stone rift plane Wet Condition	2.27	2.23	5.06	20,080	3,970
PP-W-2		2.24	2.27	5.09	15,260	3,000
PP-W-3		2.34	2.23	5.22	13,130	2,520
PP-W-4		2.27	2.24	5.09	20,590	4,050
PP-W-5		2.27	2.26	5.13	22,615	4,410
Series Average						**3,590**
Standard Deviation						794
Coefficient of Variation (%)						22.1

ASTM C170 – Compressive Strength Evaluation – Dry Condition, Perpendicular Loading

Specimen No.	Test Condition	Specimen Dimensions (in)		Loading Area (in^2)	Failure Load (lb_f)	Compressive Strength (psi)
		Length	Width			
PP-D-1	Loaded Perpendicular to stone rift plane Dry Condition	2.23	2.23	4.97	27,320	5,500
PP-D-2		2.24	2.25	5.05	27,890	5,520
PP-D-3		2.26	2.24	5.07	32,000	6,310
PP-D-4		2.28	2.27	5.16	31,200	6,050
PP-D-5		2.29	2.26	5.17	30,850	5,970
Series Average						**5,870**
Standard Deviation						352
Coefficient of Variation (%)						6.0

ASTM C170 – Compressive Strength Evaluation – Wet Condition, Parallel Loading

Specimen No.	Test Condition	Specimen Dimensions (in)		Loading Area (in^2)	Failure Load (lb_f)	Compressive Strength (psi)
		Length	Width			
LL-W-1	Loaded Parallel to stone rift plane Wet Condition	2.36	2.29	5.39	25,860	4,800
LL-W-2		2.37	2.26	5.35	23,120	4,320
LL-W-3		2.35	2.26	5.30	25,140	4,740
LL-W-4		2.36	2.25	5.30	24,100	4,550
LL-W-5		2.44	2.24	5.46	23,750	4,350
Series Average						**4,550**
Standard Deviation						219
Coefficient of Variation (%)						4.8

ASTM C170 – Compressive Strength Evaluation – Dry Condition, Parallel Loading

Specimen No.	Test Condition	Specimen Dimensions (in)		Loading Area (in^2)	Failure Load (lb_f)	Compressive Strength (psi)
		Length	Width			
LL-D-1	Loaded Parallel to stone rift plane Dry Condition	2.24	2.26	5.07	31,820	6,280
LL-D-2		2.24	2.46	5.52	36,750	6,660
LL-D-3		2.25	2.37	5.34	36,920	6,910
LL-D-4		2.24	2.38	5.34	33,080	6,190
LL-D-5		2.26	2.35	5.31	34,910	6,570
Series Average						**6,520**
Standard Deviation						292
Coefficient of Variation (%)						4.5

ASTM C99 – Modulus of Rupture Evaluation – Wet Condition, Perpendicular Loading

Specimen Details		Support Span (in)	Specimen Dimensions (in)		Failure Load (lb_f)	Modulus of Rupture (psi)
No.	**Test Condition**		**Width**	**Depth**		
PP-W-1	Loaded Perpendicular to stone rift plane Wet Condition	7.0	4.02	2.45	1,640	710
PP-W-2			4.02	2.45	1,342	580
PP-W-3			4.00	2.19	1,692	930
PP-W-4			4.01	2.37	1,470	680
PP-W-5			3.99	2.37	1,552	730
Series Average						**720**
Standard Deviation						128
Coefficient of Variation (%)						17.5

ASTM C99 – Modulus of Rupture Evaluation – Dry Condition, Perpendicular Loading

Specimen No.	Test Conditions	Support Span (in)	Specimen Dimensions (in)		Failure Load (lb_f)	Modulus of Rupture (psi)
			Width	**Depth**		
PP-D-1	Loaded Perpendicular to stone rift plane Dry Condition	7.0	4.00	2.18	2,111	1,160
PP-D-2			4.02	2.12	2,223	1,300
PP-D-3			4.03	2.17	1,613	890
PP-D-4			4.01	2.20	2,201	1,190
PP-D-5			4.01	2.13	1,446	840
Series Average						**1,080**
Standard Deviation						200
Coefficient of Variation (%)						18.5

ASTM C99 – Modulus of Rupture Evaluation – Wet Condition, Parallel Loading

Specimen Details		Support Span (in)	Specimen Dimensions (in)		Failure Load (lb_f)	Modulus of Rupture (psi)
No.	**Test Condition**		**Width**	**Depth**		
LL-W-1	Loaded Parallel to stone rift plane Wet Condition	7.0	4.00	2.28	712	360
LL-W-2			4.00	2.25	571	300
LL-W-3			4.00	2.21	455	240
LL-W-4			4.04	2.27	687	350
LL-W-5			4.02	2.30	1,047	520
Series Average						**350**
Standard Deviation						104
Coefficient of Variation (%)						29.7

ASTM C99 – Modulus of Rupture Evaluation – Dry Condition, Parallel Loading

Specimen No.	Test Conditions	Support Span (in)	Specimen Dimensions (in)		Failure Load (lb_f)	Modulus of Rupture (psi)
			Width	**Depth**		
LL-D-1	Loaded Parallel to stone rift plane Dry Condition	7.0	4.03	2.26	1,064	540
LL-D-2			4.02	2.25	1,229	630
LL-D-3			4.00	2.23	1,070	570
LL-D-4			3.99	2.24	1,071	560
LL-D-5			4.00	2.24	1,229	640
Series Average						**590**
Standard Deviation						44
Coefficient of Variation (%)						7.5

ASTM C880 – Flexural Strength Evaluation – Wet Condition, Perpendicular Loading

Specimen Details		Support Span (in)	Specimen Dimensions (in)		Failure Load (lb_f)	Flexural Strength (psi)
No.	**Test Condition**		**Width**	**Depth**		
PP-W-1	Loaded Perpendicular to stone rift plane Wet Condition	12.5	3.98	1.42	498	590
PP-W-2			4.01	1.24	506	770
PP-W-3			3.99	1.17	494	850
PP-W-4			3.98	1.35	548	710
PP-W-5			3.99	1.22	251	390
Series Average						**660**
Standard Deviation						179
Coefficient of Variation (%)						27.1

ASTM C880 – Flexural Strength Evaluation – Dry Condition, Perpendicular Loading

Specimen No.	Test Conditions	Support Span (in)	Specimen Dimensions (in)		Failure Load (lb_f)	Flexural Strength (psi)
			Width	**Depth**		
PP-D-1	Loaded Perpendicular to stone rift plane Dry Condition	12.5	3.97	1.43	889	1,030
PP-D-2			4.03	1.22	572	900
PP-D-3			3.99	1.22	538	840
PP-D-4			4.01	1.38	842	1,030
PP-D-5			4.01	1.33	679	890
Series Average						**940**
Standard Deviation						87
Coefficient of Variation (%)						9.3

ASTM C880 – Flexural Strength Evaluation – Wet Condition, Parallel Loading

Specimen Details		Support Span (in)	Specimen Dimensions (in)		Failure Load (lb_f)	Flexural Strength (psi)
No.	**Test Condition**		**Width**	**Depth**		
LL-W-1	Loaded Parallel to stone rift plane Wet Condition	12.5	3.99	1.33	266	350
LL-W-2			3.99	1.33	188	250
LL-W-3			4.00	1.33	328	440
LL-W-4			4.01	1.26	204	300
LL-W-5			4.00	1.25	204	310
Series Average						**330**
Standard Deviation						71
Coefficient of Variation (%)						21.5

ASTM C880 – Flexural Strength Evaluation – Dry Condition, Parallel Loading

Specimen No.	Test Conditions	Support Span (in)	Specimen Dimensions (in)		Failure Load (lb_f)	Flexural Strength (psi)
			Width	**Depth**		
LL-D-1	Loaded Parallel to stone rift plane Dry Condition	12.5	4.01	1.27	410	590
LL-D-2			3.99	1.33	599	800
LL-D-3			4.02	1.24	398	600
LL-D-4			3.99	1.25	438	660
LL-D-5			4.00	1.26	456	680
Series Average						**670**
Standard Deviation						84
Coefficient of Variation (%)						12.5

ASTM C666 – Post Freeze-Thaw Flexural Strength
Test Condition: Perpendicular Rift, 25-Cycle (Wet)

Specimen Details		Support Span (in)	Specimen Dimensions (in)		Failure Load (lb_f)	Flexural Strength (psi)
No.	**Test Condition**		**Width**	**Depth**		
PP-FT25-1	Loaded Perpendicular to stone rift plane Post 25-Cycles Freeze-Thaw Exposure Wet Condition	12.5	4.01	1.45	514	570
PP-FT25-2			4.01	1.37	504	620
PP-FT25-3			4.01	1.39	518	630
PP-FT25-4			4.01	1.32	446	600
PP-FT25-5			4.01	1.31	468	640
Series Average						**610**
Standard Deviation						28
Coefficient of Variation (%)						4.6

- ***No 25-cycle specimen showed readily visible signs of degradation post-exposure.***

Post Freeze-Thaw Comparative Flexural Strength Evaluation (25 Cycles C666, Proc. B)

Evaluation Condition		Result (% Change)
Perpendicular stone rift plane	Against Wet Condition Control	-7.6
	Against Preceding Freeze-Thaw Exposure Set	N/A

ASTM C666 – Post Freeze-Thaw Flexural Strength
Test Condition: Perpendicular Rift, 50-Cycle (Wet)

Specimen Details		Support Span (in)	Specimen Dimensions (in)		Failure Load (lb_f)	Flexural Strength (psi)
No.	**Test Condition**		**Width**	**Depth**		
PP-FT50-1	Loaded Perpendicular to stone rift plane Post 50-Cycles Freeze-Thaw Exposure Wet Condition	12.5	4.00	1.39	411	500
PP-FT50-2			4.02	1.43	565	650
PP-FT50-3			4.03	1.37	411	510
PP-FT50-4			4.02	1.29	420	590
PP-FT50-5			4.02	1.37	499	620
Series Average						**570**
Standard Deviation						67
Coefficient of Variation (%)						11.8

- ***No 50-cycle specimen showed readily visible signs of degradation post-exposure.***

Post Freeze-Thaw Comparative Flexural Strength Evaluation (50 Cycles C666, Proc. B)

Evaluation Condition		Result (% Change)
Perpendicular stone rift plane	Against Wet Condition Control	-13.6
	Against Preceding Freeze-Thaw Exposure Set	-6.6

ASTM C666 – Post Freeze-Thaw Flexural Strength
Test Condition: Perpendicular Rift, 75-Cycle (Wet)

Specimen Details		Support Span (in)	Specimen Dimensions (in)		Failure Load (lb_f)	Flexural Strength (psi)
No.	**Test Condition**		**Width**	**Depth**		
PP-FT75-1	Loaded Perpendicular to stone rift plane Post 75-Cycles Freeze-Thaw Exposure Wet Condition	12.5	3.94	1.36	507	650
PP-FT75-2			4.00	1.42	518	610
PP-FT75-3			3.99	1.37	561	700
PP-FT75-4			4.02	1.31	471	640
PP-FT75-5			4.02	1.28	478	680
Series Average						**660**
Standard Deviation						35
Coefficient of Variation (%)						5.3

- ***No 75-cycle specimen showed readily visible signs of degradation post-exposure.***

Post Freeze-Thaw Comparative Flexural Strength Evaluation (75 Cycles C666, Proc. B)

Evaluation Condition		Result (% Change)
Perpendicular stone rift plane	Against Wet Condition Control	0
	Against Preceding Freeze-Thaw Exposure Set	+15.8

ASTM C666 – Post Freeze-Thaw Flexural Strength
Test Condition: Perpendicular Rift, 100-Cycle (Wet)

Specimen Details		Support Span (in)	Specimen Dimensions (in)		Failure Load (lb_f)	Flexural Strength (psi)
No.	**Test Condition**		**Width**	**Depth**		
PP-FT100-1	Loaded Perpendicular to stone rift plane Post 100-Cycles Freeze-Thaw Exposure Wet Condition	12.5	4.00	1.32	481	650
PP-FT100-2			3.99	1.31	494	670
PP-FT100-3			4.01	1.39	620	750
PP-FT100-4			4.02	1.43	501	570
PP-FT100-5			3.94	1.38	473	590
Series Average						**650**
Standard Deviation						71
Coefficient of Variation (%)						10.9

- ***No 100-cycle specimen showed readily visible signs of degradation post-exposure.***

Post Freeze-Thaw Comparative Flexural Strength Evaluation (100 Cycles C666, Proc. B)

Evaluation Condition		Result (% Change)
Perpendicular stone rift plane	Against Wet Condition Control	-1.5
	Against Preceding Freeze-Thaw Exposure Set	-1.5

Conclusion: The average test results were evaluated against the performance criteria presented in ASTM C616 Table 1. The results of these evaluations are presented in the table(s) below:

ASTM C616 Performance Evaluation Summary				
Physical Requirement	**Test Series Detail**		**Result**	
			Mean Test Value	**Performance Evaluation**
C97 Absorption (%): Class I (Sandstone): ≤8.0 Class II (Quartzitic Sandstone): ≤3.0 Class III (Quartzite): ≤1.0			6.35	Meets as Stated: Class I
C97 Density (lbs/ft^3): Class I (Sandstone): ≥110 Class II (Quartzitic Sandstone): ≥135 Class III (Quartzite): ≥160			134	Meets as Stated: Class I
C170 Compressive Strength (psi): Class I (Sandstone): ≥4.000 Class II (Quartzitic Sandstone): ≥10,000 Class III (Quartzite): ≥20.000	Perpendicular	Wet	3,590	Meets as Stated: Class I
		Dry	5,870	
	Parallel	Wet	4,550	
		Dry	6,520	
C99 Modulus of Rupture (psi): Class I (Sandstone): ≥350 Class II (Quartzitic Sandstone): ≥1,000 Class III (Quartzite): ≥2,000	Perpendicular	Wet	720	Meets as Stated: Class I
		Dry	1,080	
	Parallel	Wet	350	
		Dry	590	
C1353 Abrasion Resistance: Class I (Sandstone): H_a ≥2 Class II (Quartzitic Sandstone): H_a ≥8 Class III (Quartzite): H_a ≥8			3.9	Meets as Stated: Class I
C880 Flexural Strength (psi): No Performance Criteria Stated	Perpendicular	Wet	660	Design Property Only
		Dry	940	
	Perpendicular	Wet	330	
		Dry	670	

Post Freeze-Thaw Comparative Flexural Strength Evaluation Summary				
Test Series	**Test Condition**	**Series Mean Wet Flexural Strength (psi)**	**Comparative Performance Evaluation (%)**	
			vs. Wet Control	**vs. Preceding Freeze-Thaw Exposure Set**
0 Cycle (Wet)	Loaded Perpendicular to stone rift plane Wet	660	N/A	N/A
25 Cycles (Wet)		610	-7.6	N/A
50 Cycles (Wet)		570	-13.6	-6.6
75 Cycles (Wet)		660	0	+15.8
100 Cycles (Wet)		650	-1.5	-1.5

ASTM C616 – Quartz-Based Stone Properties Evaluation

The Texas Sandstone product satisfied the ASTM C616 performance requirements for a Class I (Sandstone) product for Absorption, Density, Compressive Strength, Modulus of Rupture, and Abrasion Resistance.

There are no ASTM C616 performance criteria for ASTM C880 Flexural Strength, so these values are reported as a design property only.

ASTM C666 – Freeze-Thaw Durability Evaluation

No post-exposure freeze-thaw specimen showed readily visible signs of degradation post-exposure.

Flexural Strength change relative to unexposed control series throughout the exposure appears likely due to variation between individual specimens and does not appear to be specifically associated with the freeze-thaw exposure cycling (greatest apparent strength “loss” is observed in the 50 cycle series which is followed by apparent “recovery” to control series strength levels in the 75 cycles series).

There are no ASTM C616 performance criteria for ASTM C666 Freeze-Thaw Durability, so these values are reported as a design property only.

It has been our pleasure to provide this product testing service for your project. Please do not hesitate to contact us if you have any questions or require additional information. Contact information is listed below.

Respectfully submitted,

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Revision Log

No.	Date	Page(s)	Description
0	02/09/23	N/A	Initial report release

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Photographs

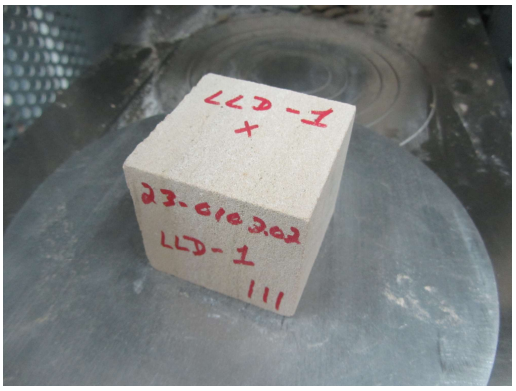

Photo No. 1
ASTM C170 – Representative Pretest Condition Specimen

Photo No. 2
ASTM C170 – Test Setup

Photo No. 3
ASTM C170 – Specimen Failure Mode: Loading Perpendicular to Rift (Dry Condition)

Photo No. 4
ASTM C170 – Specimen Failure Mode: Loading Parallel to Rift (Wet Condition)

Photo No. 5
ASTM C97 – Absorption & Density Test Setup (Wet Mass Determination Depicted)

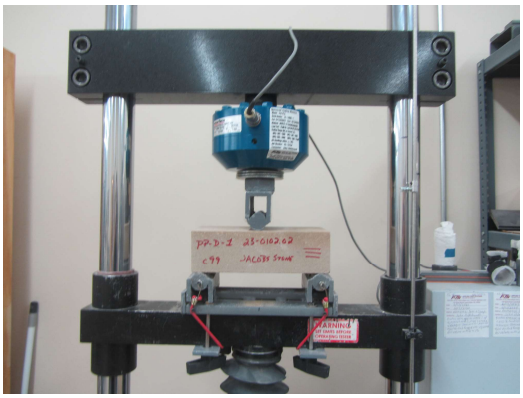

Photo No. 6
ASTM C99 – Modulus of Rupture Test Setup

Photo No. 7
ASTM C99 – Specimen Failure Mode: Loading Perpendicular to Rift (Dry Condition)

Photo No. 8
ASTM C99 – Specimen Failure Mode: Loading Parallel to Rift (Wet Condition)

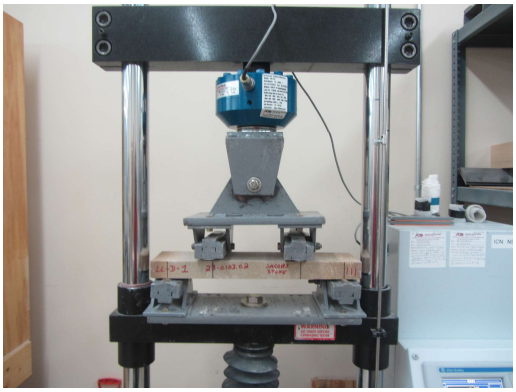

Photo No. 9
ASTM C880 – Flexural Strength Test Setup

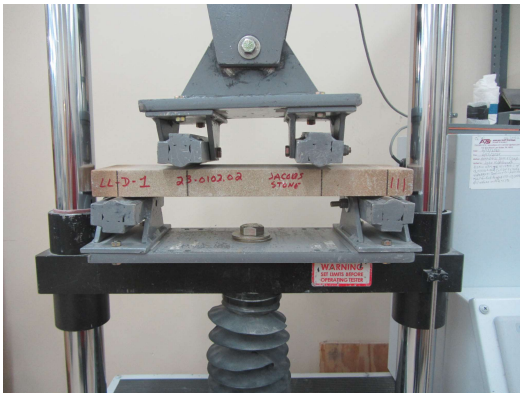

Photo No. 10
ASTM C880 – Specimen Loading Detail

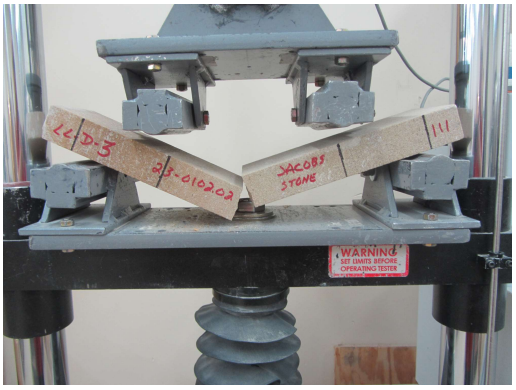

Photo No. 11
ASTM C880 – Specimen Failure Mode:
Loading Parallel to Rift
(Dry Condition)

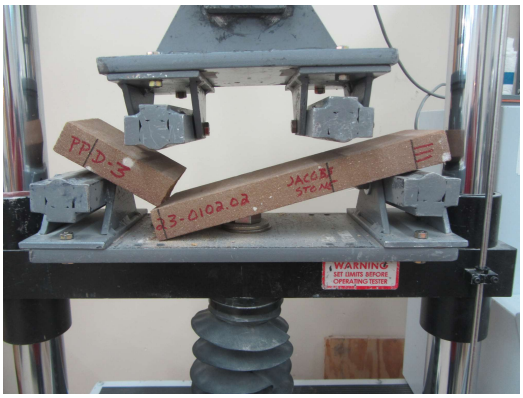

Photo No. 12
ASTM C880 – Specimen Failure Mode:
Loading Perpendicular to Rift
(Wet Condition)

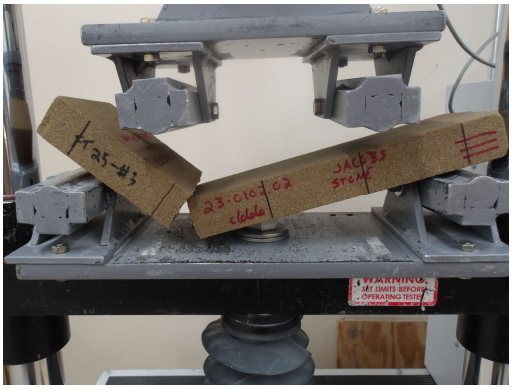

Photo No. 13
ASTM C666 (C880) - Failure Mode:
Representative 25-Cycle Specimen
(Perpendicular, Wet Condition)

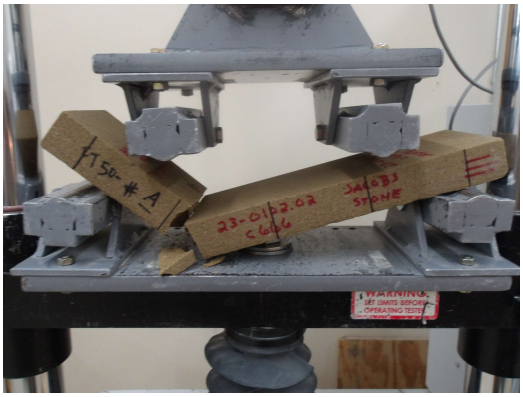

Photo No. 14
ASTM C666 (C880) - Failure Mode:
Representative 50-Cycle Specimen
(Perpendicular, Wet Condition)

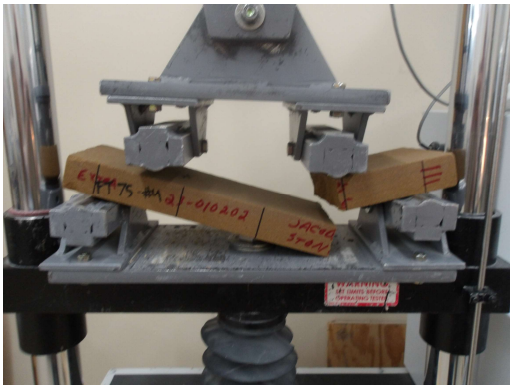

Photo No. 15
ASTM C666 (C880) - Failure Mode:
Representative 75-Cycle Specimen
(Perpendicular, Wet Condition)

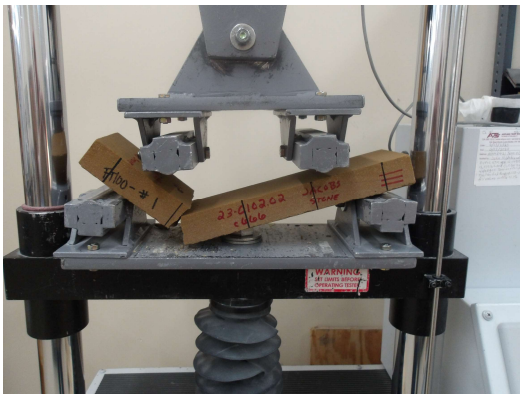

Photo No. 16
ASTM C666 (C880) - Failure Mode:
Representative 100-Cycle Specimen
(Perpendicular, Wet Condition)