

# RUSSELL STONE PRODUCTS TEST REPORT

## SCOPE OF WORK

ASTM C616 PHYSICAL PROPERTY EVALUATIONS OF NATURAL STONE (BLOOM RUN AND ROARING RUN SANDSTONE)

## REPORT NUMBER

M2495.01-106-31 R0

## TEST DATES

04/15/21 - 05/24/21

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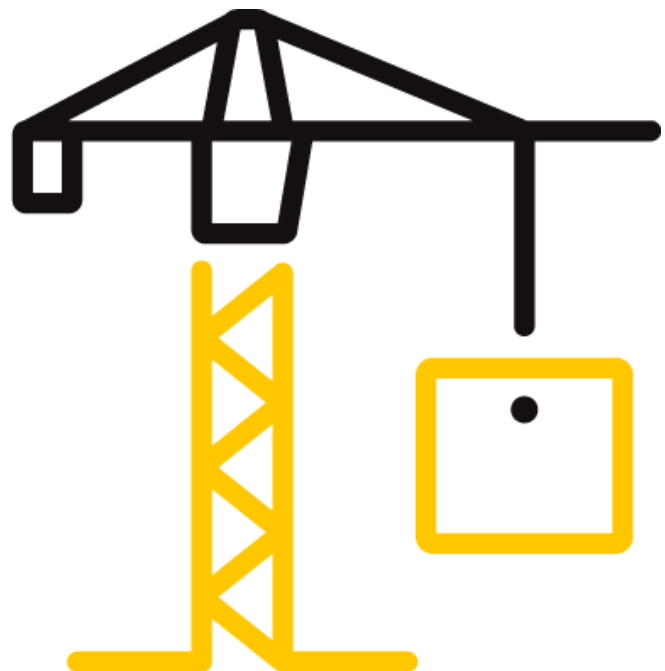
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## TEST REPORT FOR RUSSELL STONE PRODUCTS

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Date: 06/18/21

### REPORT ISSUED TO

#### RUSSELL STONE PRODUCTS

2640 Greenville Pike

Grampian, Pennsylvania 16838

### SECTION 1

#### SCOPE

**Product:** Natural Sandstone (Bloom Run and Roaring Run)

Intertek Building & Construction (B&C) was contracted by Russell Stone Products to evaluate their natural sandstone materials (Designation: Bloom Run and Roaring Run) in accordance with ASTM C97 for Absorption and Bulk Specific Gravity, ASTM C170 for Compressive Strength, ASTM C99 for Modulus of Rupture, and ASTM C1353 for Abrasion resistance in order to determine classification per ASTM C616. Results obtained are tested values and were secured by using the designated test methods. All testing was conducted at the Intertek B&C test facility in York, Pennsylvania.

This report does not constitute certification of this product nor an opinion or endorsement by this laboratory.

For INTERTEK B&C:

<b>COMPLETED BY:</b>	Cooper F. Kennedy	<b>REVIEWED BY:</b>	Scott D. Scallorn
<b>TITLE:</b>	Technician II Natural Stone & Cementitious Materials	<b>TITLE:</b>	Program Manager Natural Stone & Cementitious Materials
<b>SIGNATURE:</b>		<b>SIGNATURE:</b>	
<b>DATE:</b>	07/02/21	<b>DATE:</b>	07/02/21

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**SECTION 2**

**SUMMARY OF TEST RESULTS**

PERFORMANCE EVALUATION SUMMARY			RESULT	ASTM C616 PERFORMANCE CRITERIA	
TEST METHOD	PHYSICAL PROPERTY				
ASTM C97	Absorption (%)		1.23%	Maximum Absorption Class I: 8.0 % Class II: 3.0 % Class III: 1.0 %	
	Density (lb/ft <sup>3</sup> )		153.94	Minimum Density Class I: ≥125 lb/ft <sup>3</sup> Class II: ≥150 lb/ft <sup>3</sup> Class III: ≥160 lb/ft <sup>3</sup>	
ASTM C170	Compressive Strength (psi)	Dry	Perp	17,998	Minimum Mean Compressive Strength Class I: ≥4,000 psi Class II: ≥10,000 psi Class III: ≥20,000 psi
			Par	17,257	
		Wet	Perp	18,153	
			Par	18,677	
ASTM C99	Modulus of Rupture (psi)	Dry	Perp	1,493	Minimum Mean Modulus of Rupture Class I: ≥350 psi Class II: ≥1,000 psi Class III: ≥2,000 psi
			Par	1,573	
		Wet	Perp	1,399	
			Par	1,479	
ASTM C1353	Index of Abrasion		29.2	Minimum Index of Abrasion Class I: ≥2 Class II: ≥8 Class III: ≥8	

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### SECTION 3

#### TEST METHODS

The specimens were evaluated in accordance with the following:

**ASTM C616/C616M-15**, *Standard Specification for Quartz-Based Dimension Stone*

**ASTM C97/C97M-18**, *Standard Test Methods 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*

### SECTION 4

#### MATERIAL SOURCE

The test materials were provided by Russell Stone Products on 04/14/21 in good condition for testing and were presented as being representative of both their Bloom Run and Roaring Run sandstone products. Refer to the product description photos in Section 10. The material was tested as received with the exception of preconditioning of test specimens as required for testing. Representative materials/test specimens will be retained by Intertek B&C for a minimum of four years from the test completion date.

### SECTION 5

#### LIST OF OFFICIAL OBSERVERS

NAME	COMPANY
David M. Curulla	Russell Stone Products
Cooper F. Kennedy	Intertek B&C
Scott D. Scallorn	Intertek B&C

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**SECTION 6****TEST PROCEDURES**

All conditioning of test specimens and test conditions were at standard laboratory conditions unless otherwise reported. Refer to the test related photos in Section 10. Calibration certificates are available upon request.

**ASTM C97 - Absorption/Density Evaluation**

Specimens were oven dried at 60°C for a period of 48 hours prior to cooling and weight determination as specified in Section 7.2. The specimens were then transferred to a water bath maintained at 22 ±2°C for a 48-hour immersion exposure. The post-immersion specimens were removed, surfaced dried, and re-weighed as detailed in Section 7.3. Immediately after post-immersion weighing of the specimens, they were suspended in a 22 ±2°C water bath under a digital balance (ICN: 003449) for determination of immersed weight. Water Absorption and Bulk Specific Gravity were calculated as per the equations presented in Sections 8.1 and 11.1, respectively. Mean absorption and density values were evaluated against the performance criteria presented in ASTM C616, Table 1.

**ASTM C170 - Compressive Strength Evaluation**

Five specimens were evaluated per test condition: loaded both parallel and perpendicular to the stone rift plane in both oven-dry and 48-hr. wet condition). Specimen dimensions were measured with a 12 in. x 0.001 in. digital caliper (ICN: INT01153) and the load bearing surface calculated as per Section 9.1. As per Section 8.1, dry condition specimens were oven-dried at 60°C for a period of 48 hours prior to cooling to room temperature and testing. As per Section 8.2, wet condition specimens were immersed in a 22 ±2°C water bath for a period of 48 hours prior to removal, surface drying and testing. Compressive load was applied to each specimen with a Forney model FT 40 DR Testing Machine (ICN: Y000143) at a rate of load maintained under 100 psi/s as called for in Section 9.3 until failure was observed. Compressive strength was calculated in accordance with Section 10.1 and averaged for all test series. Mean compressive strength was evaluated against the performance criteria presented in ASTM C616, Table 1.

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**ASTM C99 - Modulus of Rupture Evaluation**

The Modulus of Rupture evaluation was performed on a SATEC Universal Testing Machine (ICN: Y002011) employing a 5,000 lb<sub>f</sub> load cell (ICN: 65607). Five specimens were evaluated per test condition (loaded both parallel and perpendicular to the stone rift plane in both oven-dry and 48-hr. wet condition). Individual specimen dimensions were measured with a 12 in. x 0.001 in. digital caliper (ICN: INT01153). As per Section 9.1, dry condition specimens were oven-dried at 60°C for a period of 48 hours prior to cooling to room temperature and testing. As per Section 9.2, wet condition specimens were immersed in a 22 ±2°C water bath for a period of 48 hours prior to removal, wiping free of surface water and testing. Upon completion of preconditioning, the specimens were individually supported at a span of 7.0 in. on 1.0 in. diameter support noses with compressive load applied at midspan through a 1.0 in. diameter loading nose at a constant rate of 1,000 lb<sub>f</sub>/min until failure was observed. Modulus of Rupture was calculated in accordance with Section 11.1 and averaged for each test series. Mean modulus of rupture was further evaluated against the performance criteria presented in ASTM C616, Table 1.

**ASTM C1353 - Abrasion Resistance**

The abrasion resistance evaluation was conducted on a Taber Abraser (ICN: Y001522). As called for in Section 8.1, the bulk specific gravity of the three nominal 4.0 in. square specimens having been previously wet-saw cut down to testable thickness of 0.45 in., was established in accordance with ASTM C97 prior to oven-drying at 60 ±2°C for 48 hours and testing for resistance to abrasion. Upon completion of the requisite oven conditioning and re-stabilization to 22 ±3°C, the pre-abrasion dry mass of each specimen was determined on a Mettler Toledo digital balance (ICN: 65216). Specimen thickness was determined with a digital micrometer (ICN: 72009) at four points along the anticipated travel path of the abramer wheel and the results averaged for each specimen. The Taber Abraser machine applied a constant downward force of 1,000 grams to each of two H-22 Calibrade Taber Industries hard abrasive wheels, while the instrument recorded the number of wear cycles completed for each specimen as it rotated below the wheels. After the completion 1,000 cycles of abrasion, each specimen was removed from the abramer machine, brushed off and evaluated for wear by re-measurement of specimen depth at the four previously evaluated points as well as re-weighed for determination of loss of both depth and mass. The Index of Abrasion was calculated in accordance with Section 9.1 and averaged for the test series. The final Index of Abrasion value was evaluated against the performance criteria presented in ASTM C616, Table 1.

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**SECTION 7**

**TEST SPECIMEN DESCRIPTIONS**

TEST PROCEDURE	NUMBER OF SPECIMENS	NOMINAL SPECIMEN DIMENSIONS	VISUAL CHARACTERISTICS
ASTM C97	5	2.25 in. cubes	Light tan sandstone with darker veining and saw-cut faces.
ASTM C170	20 (5 per test condition)	2.25 in. cubes	
ASTM C99	20 [10 per rift orientation)	4.0 in. x 8.0 in. x 2.25 in. thickness	
ASTM C1353	4	4 in. square x 0.3 in. thickness	

**SECTION 8**

**TEST RESULTS**

**ASTM C97 - Absorption and Density**

SPECIMEN NO.	MASS (g)			ABSORPTION (%)	BULK SPECIFIC GRAVITY	DENSITY (lb/ft <sup>3</sup> )
	DRY	48-HR WET	IMMERSED			
1	443.70	449.53	267.95	1.32	2.44	152.54
2	470.03	475.25	285.82	1.11	2.48	154.90
3	469.12	477.27	282.11	1.74	2.40	150.06
4	467.44	472.63	284.96	1.11	2.49	155.50
5	474.11	478.21	289.36	0.87	2.51	156.72
<b>Mean</b>				<b>1.23</b>	<b>2.47</b>	<b>153.94</b>

ASTM C616 Performance Evaluation		RESULT
CLASSIFICATION	PHYSICAL REQUIREMENT	
Class I - Sandstone	Maximum Absorption 8% Minimum Density 125 lb/ft <sup>3</sup>	<b>Satisfies Requirements for a Class II - Quartzitic Sandstone Product</b>
Class II - Quartzitic Sandstone	Maximum Absorption 3% Minimum Density 150 lb/ft <sup>3</sup>	
Class III - Quartzite	Maximum Absorption 1% Minimum Density 160 lb/ft <sup>3</sup>	

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**ASTM C170 - Compressive Strength**

SPECIMEN DETAILS			LOADING AREA (in <sup>2</sup> )	FAILURE LOAD (lbf)	COMPRESSIVE STRENGTH (psi) <sup>1</sup>	
TEST CONDITION	LOAD APPLICATION RELATIVE TO RIFT	NO.				
Dry	Perpendicular	Perp-D-1	4.922	65,850	13,379	
		Perp-D-2	4.875	88,490	18,151	
		Perp-D-3	5.135	80,500	15,678	
		Perp-D-4	4.879	95,130	19,496	
		Perp-D-5	4.971	115,750	23,284	
	Series Mean				<b>17,998</b>	
	Parallel	Par-D-1	5.131	135,740	26,454	
		Par-D-2	5.157	83,430	16,177	
		Par-D-3	4.958	64,230	12,955	
		Par-D-4	5.178	98,160	18,958	
		Par-D-5	5.219	108,450	20,780	
	Series Mean				<b>17,257</b>	
	Wet	Perpendicular	Perp-W-1	5.388	107,320	19,917
			Perp-W-2	5.157	97,950	18,993
Perp-W-3			4.908	79,880	16,276	
Perp-W-4			5.119	98,430	19,229	
Perp-W-5			5.074	131,060	25,828	
Series Mean				<b>18,153</b>		
Parallel		Par-W-1	5.186	115,910	22,349	
		Par-W-2	5.112	95,360	18,656	
		Par-W-3	5.196	75,430	14,518	
		Par-W-4	5.082	99,910	19,661	
		Par-W-5	5.018	126,410	25,190	
Series Mean				<b>18,677</b>		

<sup>1</sup> Compressive Strength results as presented have been rounded to the nearest 100 psi.

ASTM C616 PERFORMANCE EVALUATION		RESULT
CLASSIFICATION	MINIMUM REQUIREMENT	
Class I - Sandstone	Mean 4,000 psi	Satisfies Requirements for a Class II - Quartzitic Sandstone Product
Class II - Quartzitic Sandstone	Mean 10,000 psi	
Class III - Quartzite	Mean 20,000 psi	



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**ASTM C99 - Modulus of Rupture Evaluation**

SPECIMEN		SUPPORT SPAN (in)	DIMENSIONS (in)		FAILURE LOAD (lbf)	MODULUS OF RUPTURE (psi)
NO.	TEST CONDITION		WIDTH	THICKNESS		
Perp-D-1	Perpendicular to Rift Plane  DRY	7.0	4.06	2.34	3,178	1,508
Perp-D-2			4.07	2.31	1,754	849
Perp-D-3			4.07	2.29	3,592	1,762
Perp-D-4			4.09	2.33	3,082	1,462
Perp-D-5			4.11	2.3	3,914	1,882
<b>Series Mean</b>						<b>1,493</b>
<b>Standard Deviation</b>						<b>400</b>
Par-D-1	Parallel to Rift Plane  DRY	7.0	3.93	2.31	3,241	1,625
Par-D-2			3.93	2.28	3,332	1,714
Par-D-3			3.92	2.28	3,144	1,628
Par-D-4			4.04	2.36	3,173	1,488
Par-D-5			3.91	2.3	2,776	1,411
<b>Series Mean</b>						<b>1,573</b>
<b>Standard Deviation</b>						<b>122</b>
Perp-W-1	Perpendicular to Rift Plane  WET	7.0	4.05	2.32	2,700	1,302
Perp-W-2			4.07	2.28	2,599	1,285
Perp-W-3			4.03	2.3	2,693	1,323
Perp-W-4			3.98	2.3	3,176	1,587
Perp-W-5			4.06	2.31	3,081	1,499
<b>Series Mean</b>						<b>1,399</b>
<b>Standard Deviation</b>						<b>136</b>
Par-W-1	Parallel to Rift Plane  WET	7.0	3.92	2.3	2,957	1,503
Par-W-2			3.96	2.27	2,634	1,356
Par-W-3			4.05	2.31	3,180	1,548
Par-W-4			3.92	2.28	3,014	1,548
Par-W-5			4.04	2.32	2,975	1,438
<b>Series Mean</b>						<b>1,479</b>
<b>Standard Deviation</b>						<b>82</b>

ASTM C616 PERFORMANCE EVALUATION		RESULT
CLASSIFICATION	MINIMUM REQUIREMENT	
Class I - Sandstone	Mean 350 psi	Satisfies Requirements for a Class II - Quartzitic Sandstone Product
Class II - Quartzitic Sandstone	Mean 1,000 psi	
Class III - Quartzite	Mean 2,000 psi	

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**ASTM C1353 - Abrasion Resistance**

SPECIMEN NO.	MASS (g)			INDEX OF ABRASION
	INITIAL	POST-CYCLING	LOSS	
1	209.83	207.17	2.66	32.8
2	183.94	180.90	3.04	28.7
3	191.12	187.77	3.35	26.0
<b>Series Mean</b>				<b>29.2</b>

SPECIMEN NO.	REVOLUTIONS COMPLETED	THICKNESS (in)		
		INITIAL	POST-CYCLING	LOSS
1	1,000	0.342	0.321	0.021
2		0.301	0.277	0.025
3		0.317	0.293	0.024
<b>Series Mean</b>		<b>0.320</b>	<b>0.297</b>	<b>0.023</b>

ASTM C616 PERFORMANCE EVALUATION		RESULT
CLASSIFICATION	MINIMUM REQUIREMENT	
Class I - Sandstone	Index of Abrasion: 2	<b>Satisfies Requirements for a Class II - Quartzitic Sandstone Product and Class III - Quartzite Product</b>
Class II - Quartzitic Sandstone	Index of Abrasion: 8	
Class III - Quartzite	Index of Abrasion: 8	

**SECTION 9  
CONCLUSION**

The Russell Stone's Bloom Run and Roaring Run Sandstone product submittals satisfied the physical performance requirements for a Class II Quartzitic Sandstone as stated in ASTM C616, Table 1 for ASTM C97 (Density), ASTM C170 (Compressive Strength), ASTM C99 (Modulus of Rupture), and ASTM C1353 (Abrasion Resistance).

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### SECTION 10 PHOTOGRAPHS



**Photo No. 1**  
**Specimen Shipment - As Received**



**Photo No. 2**  
**ASTM C97 Absorption/Density Evaluation Test Apparatus**  
**(Immersed/Suspended Mass Determination)**

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**Photo No. 3**

**ASTM C99 Modulus of Rupture Evaluation Test Setup**



**Photo No. 4**

**ASTM C99 Representative MoR Specimen Failure Mode**

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**Photo No. 5**

**ASTM C170 Compressive Strength Evaluation Test Apparatus**



**Photo No. 6**

**ASTM C170 Compressive Evaluation Specimen Failure Mode**

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**Photo No. 7**  
**ASTM C1353 Abrasion Resistance Test Apparatus**



**Photo No. 8**  
**ASTM C1353 Abrasion Resistance Test Specimen Post-Test Condition**

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### SECTION 11

#### REVISION LOG

REVISION #	DATE	PAGES	REVISION
0	06/18/21	N/A	Original Report Issue
1	07/02/21	1, 2, 4, 10	Clarification of Stone Product Designation(s)