

TEST REPORT

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SAMPLES RECEIVED DATE: 19 June 2019

SAMPLE PLAN: Natural Stone cut to the sizes stated in the Standards below were received in "NEW" condition. Samples submitted by client.

DATE OF SAMPLING: 14 June 2019

LOCATION OF SAMPLING: Florence, TX USA

SCOPE / PURPOSE OF TESTING: To determine compliance with ASTM C 616-15 "Standard Specification for Quartz-Based Dimension Stone"
STANDARD(S) EVALUATED: ASTM C97-15 "Standard Test Method for Absorption and Bulk Specific Gravity of Dimensional Stone" and ASTM C1353-15 "Standard Test Method for Abrasion Resistance of Dimension Stone Subjected to Foot Traffic Using a Rotary Platform Abraser"¹

TESTING DATE(S): 19 June – 01 August 2019

PRODUCT DESCRIPTION(S): Natural Stone identified: Chocolate Sandstone

COMPLIANCE SUMMARY: Natural Stone identified above cut to shape as required by the standards listed above:


Average % Absorption	4.83	
Average Bulk Specific Gravity	147.2 lbs/ft ³	2 358 kg/m ³
Abrasion Resistance	– Dry	12.9 lw
Abrasion Resistance	– Wet	10.2 lw

See test results for further details

¹NOTE: For Igneous Samples we run ASTM C 241 for Sedimentary and Metamorphic Samples we run ASTM C 1353

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Form: TEi-TS-S&T002 Revision 10/07



Merrill Gee P.E. – Engineer in Charge

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ASTM C97

"Standard Test Methods for Absorption and Bulk Specific Gravity of Dimensional Stone"

1.0 SCOPE

1.1 These test methods cover the tests for determining the absorption and bulk specific gravity of all types of dimension stone, except slate.

2.0 REFERENCED DOUCMENTS – Omitted, see Standard

3.0 TERMINOLOGY

3.1 Definitions - All definitions are in accordance with Terminology C 119.

4.0 SIGNIFICANCE AND USE

4.1 These test methods are useful in indicating the differences in absorption between the various dimension stones. These test methods also provide one element in comparing stones of the same type.

ABSORPTION

5.0 SAMPLING

5.1 NOTE: Sampling was done by the Client.

6.0 TEST SPECIMENS

6.1 NOTE: The test specimens were tested "As Received". See RESULTS

7.0 PROCEDURE

7.1 NOTE: The specimens were tested in accordance with the requirements of this Section

8.0 CALCULATION

8.1 Calculate the weight percentage absorption for each specimen as follows:

$$\text{Absorption, weight \%} = [(B-A)/A] \times 100$$

where A = weight of the dried specimen, and
B = weight of the specimen after immersion

9.0 REPORT – Omitted, see Standard and RESULTS

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BULK SPECIFIC GRAVITY

10.0 PROCEDURE

10.1 NOTE: The specimens were tested in accordance with the requirements of this Section

11.0 CALCULATION

11.1 Calculate the bulk specific gravity as follows:

$$\text{Bulk specific gravity} = \frac{A}{(B-C)}$$

where: A = weight of the dried specimen,
B = weight of the soaked and surface dried specimen in air,
C = weight of soaked specimen in water.

11.2 Calculate the results to three decimal places and round off to two. Report the Average, Maximum and Minimum values.

12.0 REPORT – Omitted, see Standard and RESULTS

13.0 PRECISION AND BIAS – Omitted, see Standard

14.0 KEYWORDS – Omitted, see Standard

RESULTS

Results – As Received						
Sample	Dry Weight	Soaked/Dried Weight	Wet Weight	% Absorption	Bulk Specific Gravity X 1 000	Bulk Specific Gravity X 62.4
A	487.00	510.89	304.11	4.9055	2355.2	147.0
B	481.51	504.49	300.54	4.7725	2360.9	147.3
C	489.51	513.15	305.92	4.8293	2362.2	147.4
D	488.36	512.13	304.79	4.8673	2355.4	147.0
E	482.15	505.28	300.75	4.7973	2357.4	147.1

Average % Absorption – 4.83

Average Bulk Specific Gravity – 2 358 kg/m³ or 147.2 lb/ft³

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ASTM C1353¹

"Standard Test Method for Abrasion Resistance of Dimension Stone Subjected to Foot Traffic Using a Rotary Platform Abraser"

1.0 SCOPE

1.1 This test method covers the establishment of an index of abrasion resistance by determination of loss of volume resulting from abrasion of dimension stone as described in Terminology C119 and is based on Guide G195.

1.2 Omitted, see Standard

1.3 This test method uses a rotary platform abraser to determine the loss in volume of dimension stone caused by abrasion under controlled conditions.

1.4 This test method is useful in indicating the differences in abrasion resistance between the various dimension stones. This test method provides one element in comparing stones of the same type.

1.5 Omitted, see Standard

2.0 REFERENCED DOCUMENTS – Omitted, see Standard

3.0 TERMINOLOGY

3.1 Definitions of Terms Specific to This Standard:

3.1.1 abraser—wear testing instrument to evaluate abrasion resistance, also referred to as an abrader.

3.1.2 abrasion cycle—in abrasion testing, one or more movements of the abradant across a material surface, or the material surface across the abradant, that permits a return to its starting position. In the case of the rotary platform test method, it consists of one complete rotation of the specimen.

3.1.3 index of abrasion resistance, n —a number calculated from the weight loss of a specimen subjected to a given number of revolutions against a standard bonded abrasive wheel.

3.1.4 resurface—procedure of cleaning and refreshing the running surface of an abrasive wheel prior to or during use in testing.

3.1.5 sample, n —a geometrically regular block of stone.

3.1.6 test specimen, n —a flat prism of specified size and shape cut from the submitted sample.

4.0 SUMMARY OF TEST METHOD

4.1 A specimen is abraded using rotary rubbing action under controlled conditions of pressure and abrasive action. The test specimen is mounted on a turntable platform and turns on a vertical axis, against the sliding rotation of two abrading wheels. One abrading wheel rubs the specimen outward toward the periphery and the other, inward toward the center. The resulting abrasion marks form a pattern of crossed arcs over an area of approximately 5 in.² [30 cm²]. Resistance to abrasion is evaluated by determination of the loss of volume due to abrasion and calculation of an index of abrasion resistance.

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5.0 SIGNIFICANCE AND USE

5.1 This test method provides a means to quantify the abrasion resistance of dimension stone and may be related to end-use performance, or used to comparatively rank material performance, or both. The resistance of dimension stone to abrasion, as measured on a testing machine in the laboratory, is generally only one of several factors contributing to wear performance as experienced in the actual use of the material. Calculation of predicted life should not be based on specific abrasion data alone.

5.2 The resistance of dimension stone to abrasion may be affected by factors including test conditions; type of abradant; pressure between the specimen and abradant; mounting of the specimen; and type, kind, or amount of finishing materials.

5.3 Abrasion tests utilizing the rotary platform abraser may be subject to variation due to changes in the abradant during the course of specific tests. Depending on abradant type and test specimen, the abrading wheel surface may change (that is, become clogged) due to pick-up of finishing or other materials from test specimens. To reduce this variation, the abrading wheels may require resurfacing.

6.0 APPARATUS

NOTE: The Test Equipment used is in accordance with the Specifications found in the Section

7.0 TEST SPECIMENS

NOTE: The test specimens were tested "As Received". See RESULTS

8.0 PROCEDURE

NOTE: The Test Procedure was followed without exception as described in this Section.

9.0 CALCULATION

9.1 Calculate the index of abrasion resistance as follows:

$$I_w = \frac{36.75}{w_o - w_f} \times \rho \times \frac{n}{1000}$$

where:

I_w = index of abrasion resistance,
 w_o = initial weight of test specimen, g
 w_f = weight of test specimen after 1000 revolutions, g
 ρ = bulk specific gravity, and
 n = number of revolutions actually run during the test.

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¹NOTE: For Igneous Samples we run ASTM C 241 for Sedimentary and Metamorphic Samples we run ASTM C 1353

11.0 PRECISION AND BIAS – Omitted, see Standard

12.0 KEYWORDS – Omitted, see Standard

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RESULTS

Results - Dry					
Sample	Initial Weight	Weight Loss	Bulk Density	Number of Revolutions	Index of Resistance (lw)
a	487.00	480.32	2.358	1 000	12.97
b	481.51	474.73		1 000	12.78
c	489.51	482.81		1 000	12.93

Results - Wet					
Sample	Initial Weight	Weight Loss	Bulk Density	Number of Revolutions	Index of Resistance (lw)
a	488.36	479.62	2.358	1 000	9.91
b	482.15	473.46		1 000	9.97
c	485.21	477.08		1 000	10.66

The tests were conducted at 32% Relative Humidity @ 74 °F

Average Abrasion Resistance = Dry 12.9 lw
Wet 10.2 lw

CONCLUSION:

The material has the following average properties:

Average % Absorption 4.83
Average Bulk Specific Gravity 147.2 lbs/ft³ 2 358 kg/m³

Abrasion Resistance Dry 12.9 lw
Wet 10.2 lw

¹NOTE: For Igneous Samples we run ASTM C 241 for Sedimentary and Metamorphic Samples we run ASTM C 1353

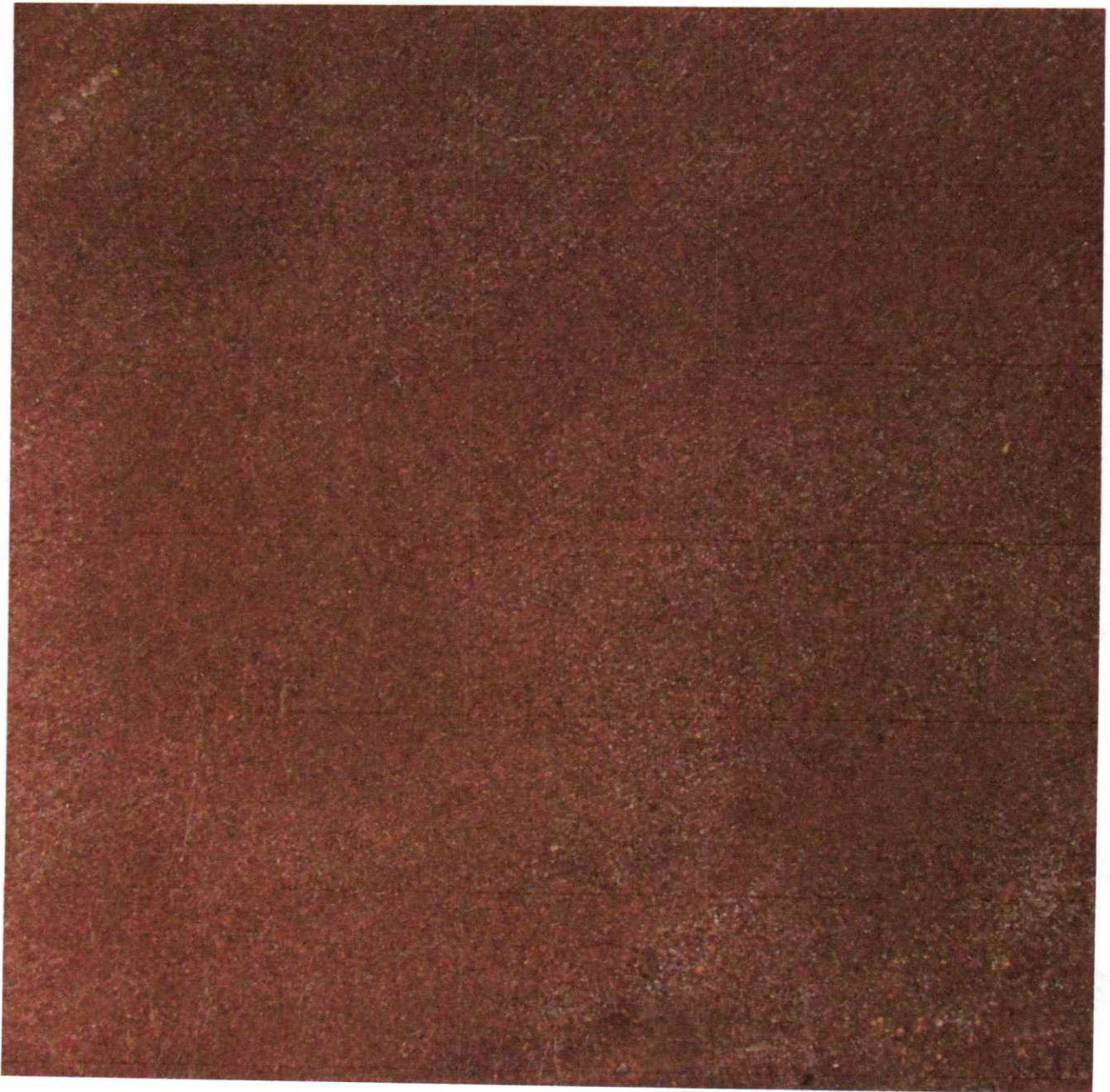
END OF ANALYSIS

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Requirements for Quartz Base Dimensional Stone According to ASTM C 616

Property	Test Requirements	Classifications
Absorption by weight, max, %	8 3 1	I Sandstone II Quartzitic Sandstone III Quartzite
Density, min, lb/ft ³ [kg/m ³]	125 [2000] 150 [2400] 160 [2560]	I Sandstone II Quartzitic Sandstone III Quartzite
Compressive strength, min, psi (MPa)	4 000 [28] 10 000 [69] 20 000 [140]	I Sandstone II Quartzitic Sandstone III Quartzite
Modulus of rupture min, psi (MPa)	350 [2.4] 1 000 [6.9] 2 000 [13.8]	I Sandstone II Quartzitic Sandstone III Quartzite
Abrasion resistance, min Ha	2 8 8	I Sandstone II Quartzitic Sandstone III Quartzite

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Sample as Received