



March 17, 2020

Mr. Jeff Roberts
GSI Engineering
4503 E. 47th Street
South Wichita, Kansas 67210

Phone: 316-554-0725
Email: jroberts@gsinetwork.com

Subject: **Report of Results of Stone Testing**
Product Name: Type M
TEC Services Project Number: TEC 20-1579
TEC Services Laboratory Number: 20-238-M

Dear Mr. Roberts:

SGS TEC Services is an AASHTO R18, ANS/ISO/IEC 17025:2005, and Army Corps of Engineering accredited laboratory. SGS TEC Services is pleased to submit this report of test results on the submitted stone specimens designated as “Type M” that were received at our facility in February of 2020. Testing was performed in accordance with the terms of the signed service agreement (TEC-PRO-20-1579). These test results pertain only to the samples tested.

GSI Engineering requested the submitted specimens be tested in accordance with ASTM C99-18 *Standard Test Method for Modulus of Rupture of Dimension Stone* and ASTM C241-15 *Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic*. A total of five specimens measuring approximately 2 ¼ x 4 x 8 inches were received for the C99 testing. A total of three specimens measuring 2 x 2 x 1 inches were received for the C241 testing. The five C99 specimens were to be tested in the dry condition. The dry condition specimens were oven dried for 48 hours at 60°C prior to testing. The specimens were tested using a 7.00-inch span length at a loading rate of 1,000 lbf/min until failure. Results of the C99 modulus of rupture testing are reported in Table 1. The results of the C241 testing are reported in Table 2.



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Table 1 – ASTM C99 Modulus of Rupture Test Results

Dry Condition Test Results						
Specimen I.D.	Date Tested	Width (in)	Depth (in)	Span Length (in)	Maximum Loads (lbs)	Modulus of Rupture (psi)
20-328-M1	3/12/2020	4.10	2.22	7.00	1,686	876
20-328-M2	3/12/2020	4.13	2.30	7.00	1,914	920
20-328-M3	3/12/2020	4.10	2.32	7.00	1,642	781
20-328-M4	3/12/2020	4.09	2.31	7.00	1,828	879
20-328-M5	3/12/2020	4.09	2.31	7.00	1,587	764
Average						844

Table 2 – ASTM C241 Foot Traffic Abrasion Resistance Test Results

Specimen ID	Initial Weight (g)	Final Weight (g)	Weight Loss (g)	Saturated Weight (g)	Saturated Suspended Weight (g)	Bulk Density	Abrasive Hardness Value (H_a)
20-328-M1	165.60	163.30	2.30	173.3	99.0	2.23	10.49
20-328-M2	168.90	166.90	2.00	177.7	100.7	2.19	11.89
20-328-M3	159.80	156.30	3.50	166.2	94.0	2.21	6.82
Average	164.77	162.17	2.60	172.4	97.9	2.21	9.73

We appreciate the opportunity to provide our services to you on this project. Should you have any questions or comments regarding this report, please feel free to contact us at your convenience.

Sincerely,

SGS TEC Services



Chip P. Sherwood Jr.
Project Manager



Shawn P. McCormick
Laboratory Principal

July 10, 2018

Transmitted via e-mail

Subject: Flexural Strength Report

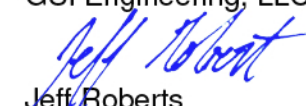
GSI Engineering, LLC (GSI) received ten limestone samples from the Silverdale quarry for laboratory flexural strength testing. The limestone samples were tested on January 10, 2020. Test results for the samples are summarized in the table below.

Sample No.	Conditioning	Width (in)	Thickness (in)	Span	Load (lbs)	Strength (psi)
K1	Dry (48 hours)	4.07	1.37	13.7	440	590
K2	Dry (48 hours)	4.10	1.33	13.3	400	550
K3	Dry (48 hours)	4.08	1.28	12.8	370	530
K4	Dry (48 hours)	4.04	1.39	13.8	720	960
K5	Dry (48 hours)	4.10	1.31	13.0	420	590
M1	Dry (48 hours)	4.11	1.36	13.6	500	670
M2	Dry (48 hours)	4.08	1.36	13.6	750	1,020
M3	Dry (48 hours)	4.05	1.30	13.0	600	850
M4	Dry (48 hours)	4.12	1.30	13.0	440	610
M5	Dry (48 hours)	3.99	1.35	13.5	450	630

ASTM C880: Flexural Strength of Dimension Stone

Please contact our office if you have any questions on the enclosed, or if you would like further information.

Respectfully submitted,
GSI Engineering, LLC

A blue ink signature of Jeff Roberts.

Jeff Roberts
Project Manager

JR/ej

July 10, 2018

Transmitted via e-mail

Subject: Compressive Strength Report

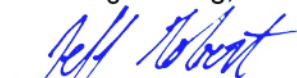
GSI Engineering, LLC (GSI) received ten limestone samples from the Silverdale quarry for laboratory compressive strength testing. The limestone samples were tested on January 13, 2020. Test results for the samples are summarized in the table below.

Sample No.	Conditioning	Width (in)	Thickness (in)	Load (lbs)	Strength (psi)
K1	Dry (48 hours)	3.05	3.11	16,800	1,770
K2	Dry (48 hours)	3.07	3.07	31,200	3,280
K3	Dry (48 hours)	3.07	3.07	27,130	2,870
K4	Dry (48 hours)	3.08	3.08	29,980	3,190
K5	Dry (48 hours)	3.06	3.06	31,990	3,380
M1	Dry (48 hours)	3.11	3.05	48,680	5,140
M2	Dry (48 hours)	3.06	3.05	39,150	4,190
M3	Dry (48 hours)	3.08	3.05	35,240	3,750
M4	Dry (48 hours)	3.10	3.10	40,610	4,230
M5	Dry (48 hours)	3.04	3.06	27,730	2,980

ASTM C170: Compressive Strength of Dimension Stone

Please contact our office if you have any questions on the enclosed, or if you would like further information.

Respectfully submitted,
GSI Engineering, LLC



Jeff Roberts
Project Manager

JR/ej

July 10, 2018

Transmitted via e-mail

Subject: Absorption and Specific Gravity Report

GSI Engineering, LLC (GSI) received ten limestone samples from the Silverdale quarry for laboratory absorption and specific gravity testing. The limestone samples were tested on January 10, 2020. Test results for the samples are summarized in the table below.

Sample No.	Conditioning	Dry Mass (g)	SSD Mass (g)	Sample Mass in Water (g)	Density (lb/ft ³)	Specific Gravity	Absorption (%)
K1	Dry (48 hours)	970.8	1,064.5	593.2	128.5	2.060	9.65
K2	Dry (48 hours)	973.2	1,061.6	592.9	129.5	2.076	9.08
K3	Dry (48 hours)	959.6	1,047.3	584.8	129.5	2.075	9.14
K4	Dry (48 hours)	971.7	1,063.4	594.3	129.2	2.071	9.44
K5	Dry (48 hours)	977.7	1,066.9	594.8	129.2	2.070	9.12
M1	Dry (48 hours)	1,010.9	1,083.6	613.2	134.1	2.149	7.19
M2	Dry (48 hours)	1,006.4	1,078.7	611.2	134.3	2.153	7.18
M3	Dry (48 hours)	996.8	1,070.5	606.1	133.9	2.146	7.39
M4	Dry (48 hours)	992.6	1,067.2	602.6	133.3	2.136	7.52
M5	Dry (48 hours)	975.2	1,050.7	589.3	131.9	2.113	7.74

ASTM C97: Absorption and Bulk Specific Gravity of Dimension Stone

Please contact our office if you have any questions on the enclosed, or if you would like further information.

Respectfully submitted,
GSI Engineering, LLC

A handwritten signature in blue ink, appearing to read 'Jeff Roberts'.

Jeff Roberts
Project Manager

JR/ej