



Soroush Stone & Mine Industry Co.



Technical Properties

Souran Black Granite

Soroush Stone Company

Tests By Building Stone Lab @ Tarbiat Modares University

2022



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Chemical test results

XRF for Souran black granite



L.O.I (%)	SiO ₂ (%)	Al ₂ O ₃ (%)	K ₂ O (%)	CaO (%)	Na ₂ O (%)	Fe ₂ O ₃ (%)	MgO (%)	TiO ₂ (%)	MnO (%)	P ₂ O ₅ (%)	SO ₃ (%)	-+Sr+Zn Rb+Cl
0.15	61.35	16.97	1.30	6.50	3.28	6.44	2.47	0.92	0.17	0.24	0.048	0.17

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Radioactivity test

Radon concentration of Souran black granite



Radon concentration (Bq/m ³)	Surface emission rate (mBq/m ² s)
19.4 ± 6.76	2.55 ± 0.45

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Physical properties



Sample number	Free water absorption	Forced Water absorption(%)	Effective porosity (%)	Specific gravity	Saturated density (gr.cm ³)	Dry density (gr.cm ³)
1	0.16	0.17	0.48	2.81	2.81	2.80
2	0.15	0.16	0.45	2.81	2.80	2.80
3	0.16	0.17	0.47	2.82	2.81	2.80
4	0.16	0.17	0.46	2.81	2.80	2.79
5	0.16	0.18	0.50	2.81	2.80	2.80
6	0.17	0.17	0.48	2.80	2.80	2.79
7	0.16	0.16	0.46	2.81	2.80	2.80
8	0.17	0.18	0.50	2.81	2.80	2.80
9	0.16	0.16	0.46	2.81	2.80	2.79
10	0.15	0.17	0.46	2.76	2.77	2.76
Average	0.16	0.17	0.47	2.81	2.80	2.79

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Mechanical properties

Strength properties of Souran black granite



Sample	Uniaxial compressive strength (MPa)	Tensile strength (MPa)	Flexural strength (MPa)
1	187.76	19.26	29.05
2	180.41	17.76	26.98
3	178.16	20.72	26.98
4	185.31	19.35	25.94
5	177.35	19.55	-
Average	181.80	19.33	27.24

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Salt crystallization test

Changes in sample weight and initial wave speed after 15 cycles of salt crystallization



Cycle	Weight variation (%)	P-wave velocity (m/s)	P-wave velocity variation (%)
0	0.00	5620	0.00
5	+0.07	5869	+4.43
10	+0.11	5558	-1.11
15	0.12	5305	-5.60

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Freeze-Thaw test

Average variation in dry weight and P-wave velocity of stone during freeze-thaw

Freezing-thaw test was performed up to 15 cycles and the variation in color, dry weight and Pwave velocity were investigated after every 5 cycles. Weight measurements showed there was not aligned weight loss after 15 cycles of freeze-thaw test (Table 10). The stone is a high durable stone against frost action. The investigation of P-wave velocity showed that this parameter decreased about 6.82% of initial value after 15 cycles. No cracks or fractures were observed on the surface of the stone.



Cycle	Weight variation (%)	P-wave velocity (m/s)	P-wave velocity variation (%)
0	0.00	5592	0.00
5	0.00	5264	5.86
10	0.00	5256	6.00
15	0.00	5210	6.82

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Wetting-drying resistance test



Average variation in dry weight and P-wave velocity of stone during wetting and drying in acid solution

Cycle	Weight variation (%)	P-wave velocity (m/s)	P-wave velocity variation (%)
0	0.00	5556	0.00
5	0.00	5508	-0.86
10	0.00	5499	-1.03
15	-0.01	5479	-1.39



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Variation in color parameters during wetting and drying in acid solution



The negative parameters of this part indicate the low percentage of iron and rusting of Souran black granite

Cycle	L brilliance	a Red to green coordinates	b Blue to yellow coordinates	ΔE color change
0	52.71	-1.58	-0.40	0.00
5	52.12	-1.36	-0.26	0.64
10	51.68	-1.25	-0.21	1.09
15	51.42	-1.10	-0.18	1.39



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Thermal Shock



Thermal shock tests were performed up to 15 cycles and the variation in color, dry weight and Pwave velocity were investigated after every 5 cycles.

Cycle	Weight variation (%)	P-wave velocity (m/s)	P-wave velocity variation (%)
0	0.00	5417	0.00
5	-0.02	5111	-5.65
10	-0.03	5001	-7.68
15	-0.04	4904	-9.48



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Thermal Shock



Variation in color parameters during thermal cycles

Cycle	L	a	b	ΔE
0	44.81	-2.03	-0.21	0.00
5	42.25	-1.98	-0.16	2.57
10	41.36	-1.83	-0.15	3.48
15	39.53	-1.75	-0.31	5.31



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Overall Quality of Souran black granite



Description and quality of Souran black granite in terms of physical and mechanical properties

Parameters	Description
Radiation	Under permissible level
Porosity	Very low
Free Water absorption	Very low
Capillary water absorption	Very low
Compressive strength	High
Tensile strength	High
Flexural strength	High



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Description and quality of Souran black granite in terms of durability



Parameter	Engineering properties	Color change
Salt crystallization	Very Good	No Significant Color Change
Freeze-thaw	Very Good	No Significant Color Change
Resistance to acid	Very Good	No Significant Color Change
Resistance to Thermal shock	Good	No Significant Color Change
Wetting and drying	Very Good	No Significant Color Change
Resistance to combination processes	Good	Color Change

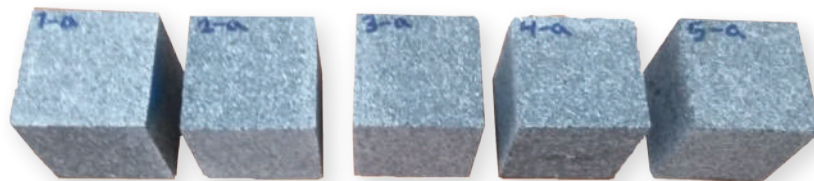


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Variation in color parameters during wetting and drying in acid solution



Figure Samples after 15 cycles of wetting and drying in acid solution

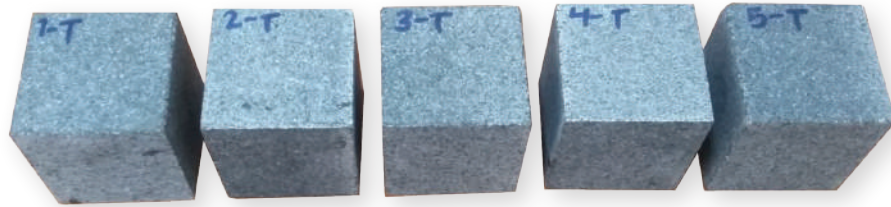


Resistance to combination of weathering processes



Figure Samples after 15 cycles of thermal shock

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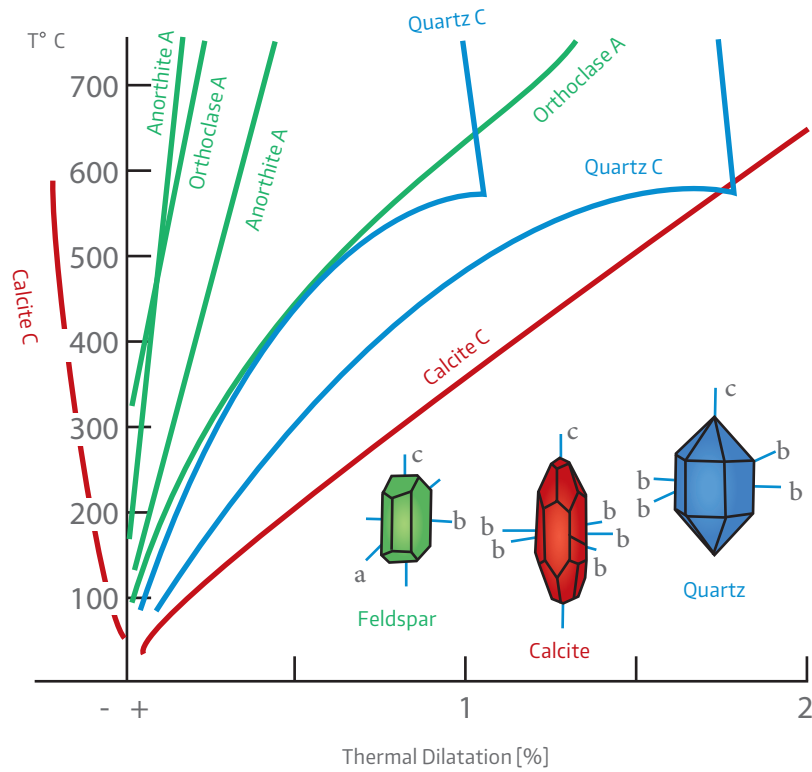


Thermal Shock



Thermal expansion of quartz, calcite and feldspar minerals with temperature change

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Application of Souran black granite based on laboratory results



Suggested items for using Souran black granite

Recommendation	Application
It is recommended for urban area with possible acid deposition in the shortterm.	External façade
It is recommended to be used in coastal areas with possible salt attack It is recommended to be used in areas with cold and hot climate	
It is recommended for urban area with possible frost action and where stone experience thermal shocks	
It is recommended	indoor decoration
It is recommended	External paving and stair
It is recommended	Indoor stair and paving
The PH of water must be around 7	Fountain

Granite Stone Analysis Standard



analysis	Standard
Thermal shock	EN 14066
Wetting-drying	ASTM D5313/D5313M-21
Physical properties	EN 1936- ASTM C97
Freeze-thaw	EN 12371-ASTM D5312/D5312M-21
Salt crystallization RILEM	French standard 1991
Flexural strength	EN 13161 - ASTM C880
Uniaxial compressive strength	EN 1926 (2007) – ASTM C170
Capillary water absorption	EN 1925
Free water absorption	EN13755
Petrographic properties	EN 12407

