



**Physical, Mechanical and Durability Tests**

Report No/Date: 118a / 09 February, 2009

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**MARE STONE TECHNOLOGIES**

Mechanical, physical and durability tests indicated below were done according to American (ASTM) and Turkish Standards (TS) on the man-made cement based samples with the commercial name of “MARESTONE” which were sent to our laboratory with your application dated January 2nd, 2008.

The results are shown below.

**1- Water Absorption and Bulk Specific Gravity Tests:**

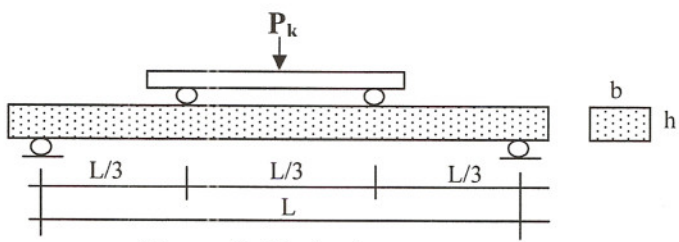
Tests were done according to **ASTM C97** (*Standard Test methods for Absorption and Bulk Specific Gravity of Dimension Stone*) and the results are given below.

**Table 1:** Absorption and Bulk Specific Gravity Test Results

Sample No	Color	Dry Specific Gravity (kg/m <sup>3</sup> )	SSD Specific Gravity (kg/m <sup>3</sup> )	Water Absorption by Weight (%)
1	Cream	2367	2395	1,21
2		2371	2396	1,06
3		2359	2383	1,01
4		2383	2405	0,94
5		2369	2391	0,92
6	Beige	2359	2385	1,13
7		2348	2371	0,98
8		2334	2363	1,25
9	Grey	2339	2365	1,12
10		2350	2377	1,16
11		2345	2366	0,89
12		2351	2375	1,03

**2- Flexural Test Results:**

Tests were done according to **ASTM C880** (*Standard Test Method for Flexural Strength of Dimension Stone*) using the quarter-point loading method. Samples were tested under laboratory dry condition. Diagrammatic view of the apparatus for the flexural test of the samples and the results are shown below. Test results are shown in Table 2.



**Figure 1: Test setup**

**Table 2: Flexural test results**

Sample no	Color	Cross-section (bxh)	Span Length L (mm)	Flexural Strength (N/mm <sup>2</sup> )
1	Grey	50,6 x 15,6	180	16,3
2		51,1 x 16,0		17,0
3		51,0 x 15,6		17,7
4		51,0 x 16,2		15,9
5		50,7 x 15,6		16,9
6	Beige	51,3 x 16,9	180	18,0
7		51,8 x 16,9		16,4
8		51,2 x 17,1		17,2
9		51,5 x 17,1		18,1
10		51,3 x 17,0		18,1
11	Cream	51,8 x 15,9	180	16,5
12		51,5 x 16,0		15,2
13		51,3 x 16,1		14,3
14		51,4 x 15,9		15,3
15		51,8 x 16,0		14,2

### **3- Abrasion Test Results:**

Tests were done according to **TS 699** (*Methods of Testing for Natural Building Stones*) using "Bohme Abrasion Test Method". Results are given in Table 3.

**Table 3: Bohme Abrasion Test Results**

Sample No	Loss of Abrasion (cm <sup>3</sup> /50cm <sup>2</sup> )
1*	8,0
2*	8,1
3*	8,9
4	11,3
5	10,8
6	11,1
7	11,0

\* Stones containing % 3 silica in the mix.

#### 4- Thermal Expansion and Contraction Test Results:

The reference gauge length readings for the thermal expansion and contraction tests were done at +20°C on 50 x 300 x 1,2mm sized samples. Then the samples were kept at -25 °C for 24 hours and the contraction of the samples was recorded using a dial gauge with a 0.01mm precision. After cold conditioning, the samples were kept in a +20°C environment for 24 hours and then the samples are conditioned at +65°C for 24 hours and the expansions were determined. Test results are shown in Table 4.

**Table 4:** Thermal Expansion and Contraction Test Results

Sample No	Backing mesh	+20°C / -25°C Thermal Change (Contraction) (mm/m)	+20°C / +65°C Thermal Change (Expansion) (mm/m)
1	Yes	0,43	0,48
2		0,50	0,60
3		0,35	0,40
4		0,45	0,35
5		0,45	0,40
6	No	0,50	0,40
7		0,43	0,40
8		0,45	0,37
9		0,44	0,40
10		0,40	0,35

#### 5- Freze and Thaw Test Results:

Samples with and without backing were tested between +20 C° and -20 C° for 100 cycles. In each cycle, stones were put in +20 C° water for two hours and then in -20 C° deep freezer for two hours. At the end of the 100 cycles, samples are dried up in the laboratory conditions and tested according to **ASTM C 880** (*Standard Test Method for Flexural Strength of Dimension Stone*). Results are given in Table 5.

After 100 freeze and thaw cycles, no chipping or cracking were observed on the samples.

**Table 5:** Flexural test results after 100 freeze and thaw cycles.


Sample no	Color	Cross Section (bxh)	Span Length (mm)	Flexural Strength (N/mm <sup>2</sup> )
1	Grey	51,2x16,2	180	13,5
2		51,1x16,1		11,8
3		51,2x16,0		13,1
4		50,8x15,9		13,1
5		51,5x16,0		13,6

**Table 5 (Cont.):** Flexural test results after 100 freeze and thaw cycles.

Sample no	Color	Cross Section (bxh)	Span Length (mm)	Flexural Strength (N/mm <sup>2</sup> )
6	Beige	51,3x17,0	180	13,5
7		51,6x16,9		15,1
8		51,0x17,0		16,0
9		51,3x17,0		13,4
10		51,2x16,9		14,1
11		51,3x16,0		180
12	51,2x16,0	14,2		
13	51,4x16,0	13,3		
14	51,0x16,0	12,8		
15	50,6x16,0	11,8		



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