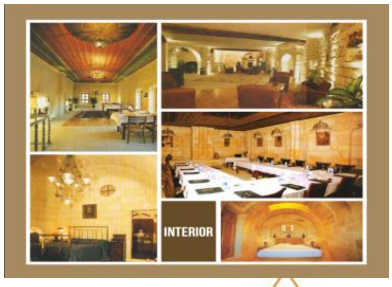
WONDER STONES FROM TURKEY & EXCLUSIVE BUILDING MATERIALS

- STAINED GLASS
- CRYSTAL LUMINARIES/
- LIGHTHINGS

Presented by

TrisM Kontrak Sdn Bhd (709885T)



trisM KONTRAK

Co No 709885T

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Wonder Stones from Cappadocia, Turkey

Cappadocia lies in central Anatolia, in the heartland of what is now Turkey. The relief consists of a high plateau over 1000m in altitude that is pierced by volcanic peaks, with Mount Erciyes (ancient Argaeus) near Kayseri (ancient Caesarea) being the tallest at 3916m.

Due to its inland location and high altitude, Cappadocia has a markedly continental climate, with hot dry summers and cold snowy winters. Rainfall is sparse and the region is largely semi-arid.

Benefit of Wonder Stones

Resistant to 2000°C and is preferred for making high temperature ovens

- The stones that keep the places that are used cool in summer and warm in winter cold, have become the basic building material which is preferred primarily in architecture
- The stone used in Southeast Anatolia is splinter, minaret rock, air stone (white stone)
- The air stone is soft and white like chalk and is easily cut and processed.
- The temperature of interior will be cool.
- No need for insulation and painting.
- No spider-web problem.
- Durable as long as the Earth continues to turn as it lasts for 500 years.
- The special stones if they were to be made for bedroom, a normal recommended of 8 hours sleeping can be reduced to 3 hours in view of its "energy recharge" properties.

Technical Characteristics

- These stones have great insulation advantage for heat and noise.
- Water Consistency: Recent surveys show that; Having stones is 31.1% and the proportion of water suction is 24.83% completely submerged in water.
- Water Permeability: The examples, which are dried in normal heat, shows that the stones are completely water resistant.
- The Effects Of The Heat: In most examples, deformation starts at 310°C ; but, in this stones its starts at 1280°C and even with an extra pressure, there are not any deformation and fusion.
- Hardness: According to shore hardness tool tests, the shore hardness degrees of the stones are between 55-65.

The Mechanical Characteristics

- Pressure resistance with one axis = in three different examples, the results 150-170-205- kg/cm2 are found.
- Pressure Resistance with Three Axis = this is given MOHR diagram in addition.
- Cohesion is 28-40 kg/cm2 and interior friction Angle is 48 go

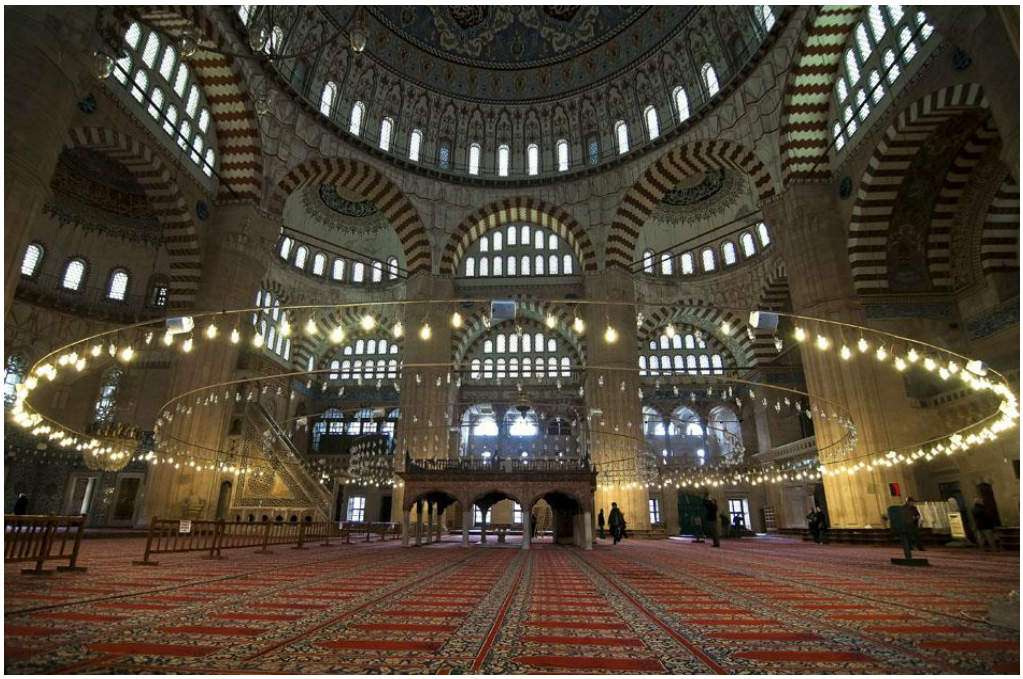
Pulling Resistance =18-23 kg/cm2
Bending Resistance = 13-19 kg/cm2
Pointed Loading Resistance = 9-14 kg/cm2

- Static and elasticize module is Ed 4.7.000 km/cm2

WIDELY USED FOR EXTERIOR & INTERIOR OF MOSQUES PROJECTS REFLECTING THE RICH OTTOMAN EMPIRE ARCHITECTURAL DESIGN

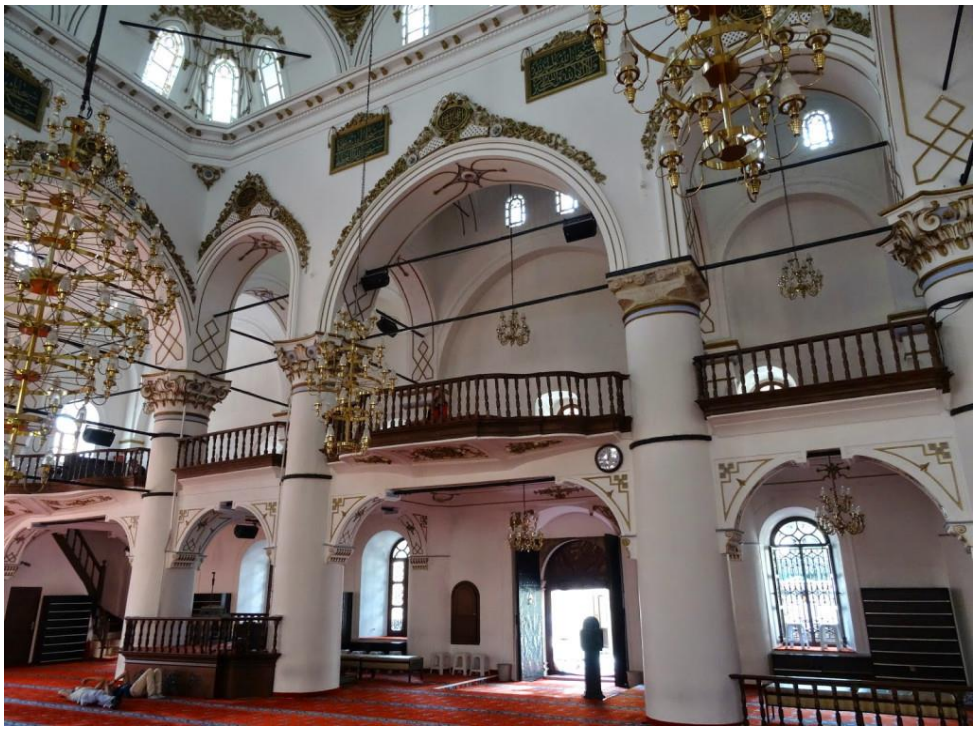
Ortaköy Camii

Eminönü Yeni Cami

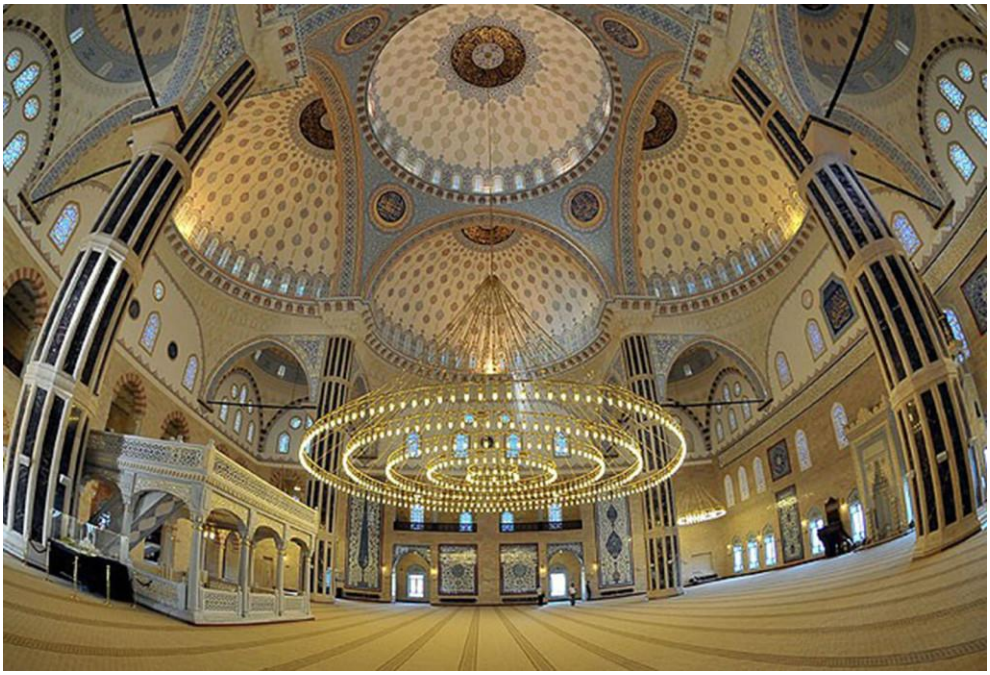


Selimiye Camii

Kümbet Camii

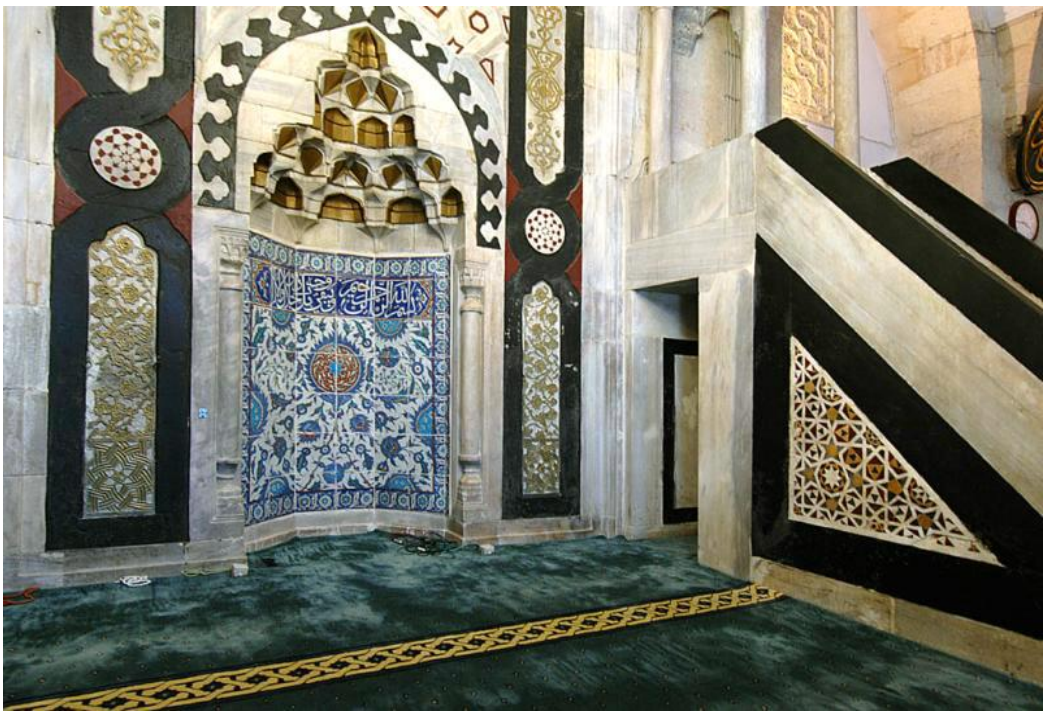


İzmir Hisar Camii



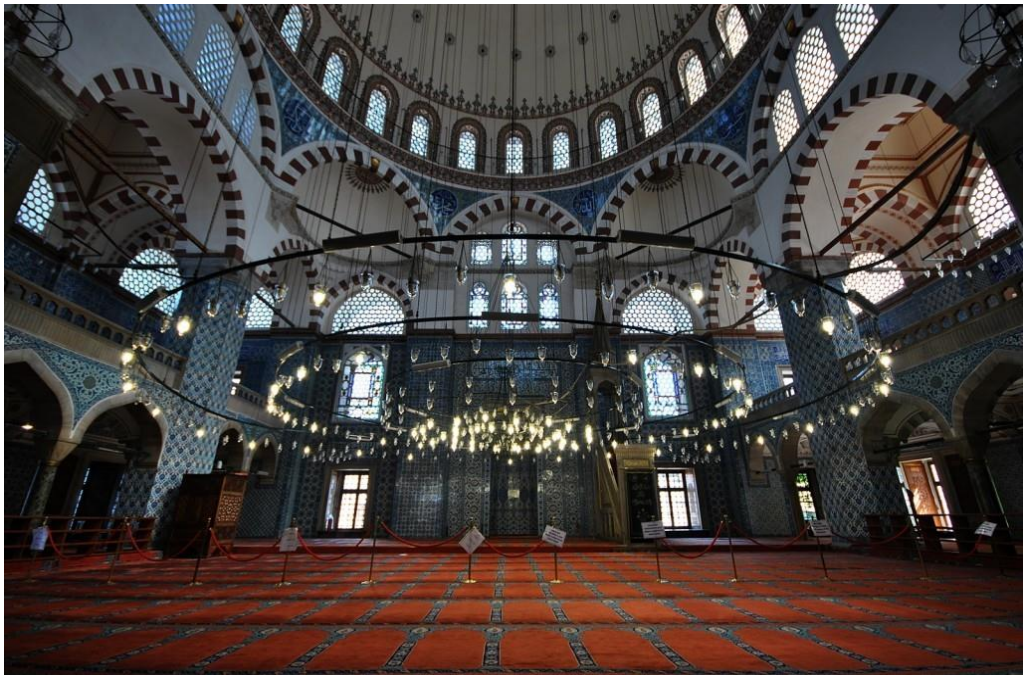
Kahramanmaraş Abdulhamit Han Cami

Sultan Ahmet Cami



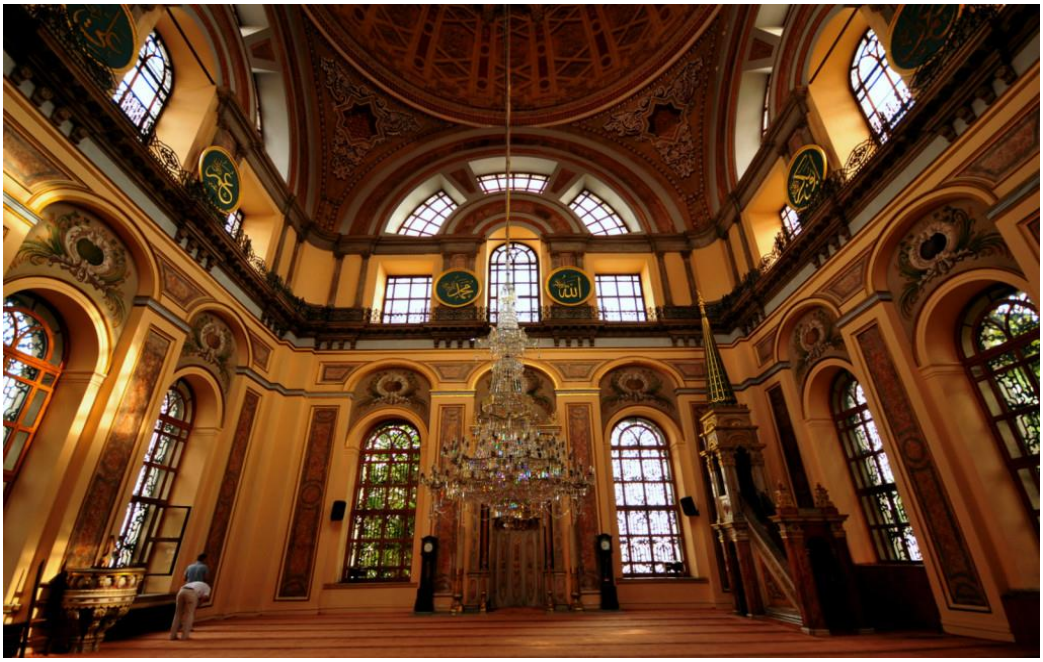
Adana Ulu Camii

Süleymaniye Camii

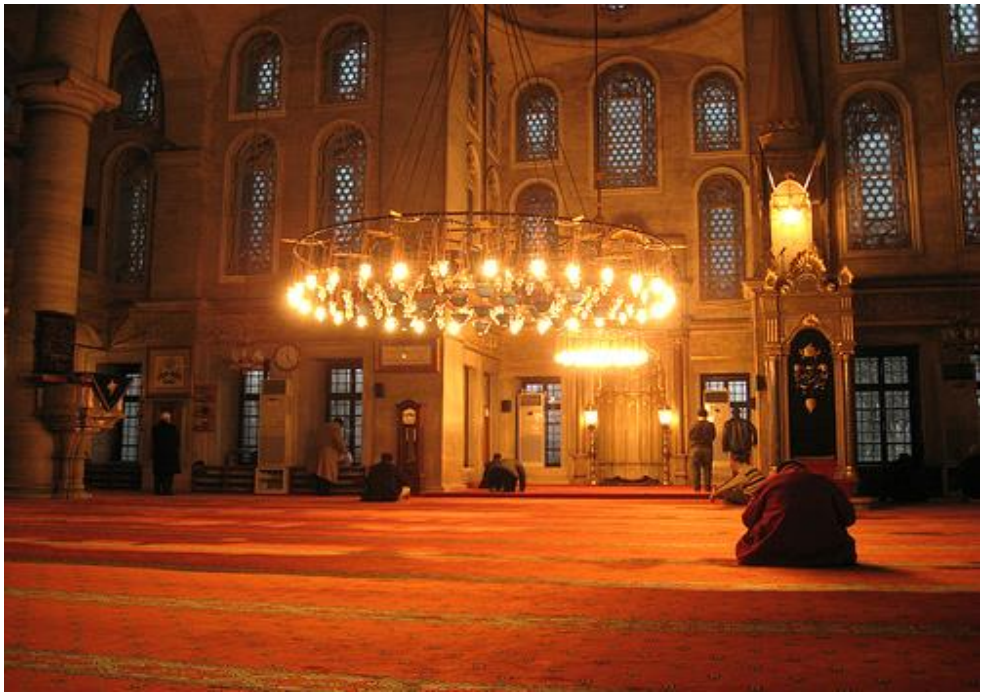


Rüstem Paşa Camii

Fatih Camii

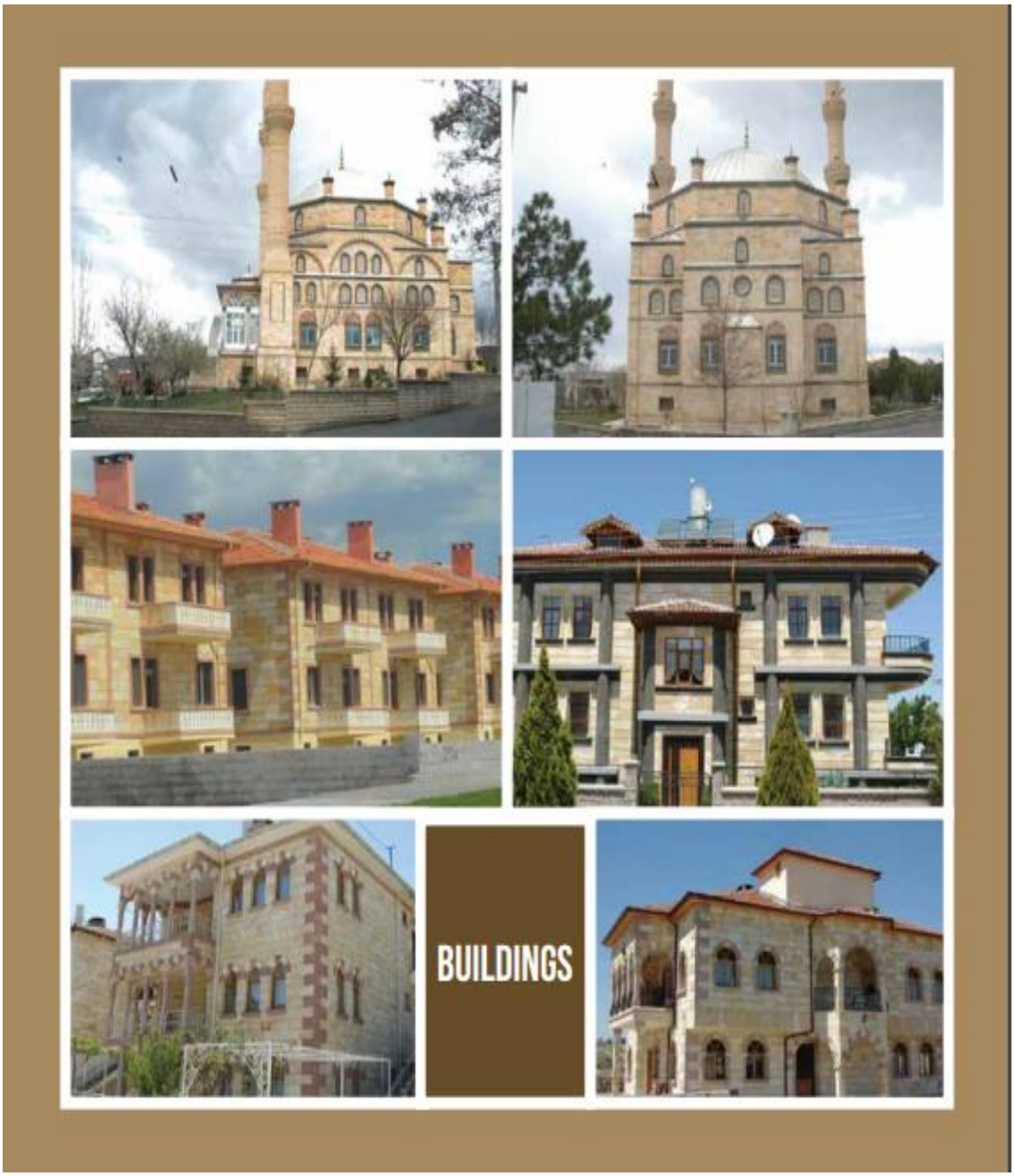


Dolmabahçe Camii

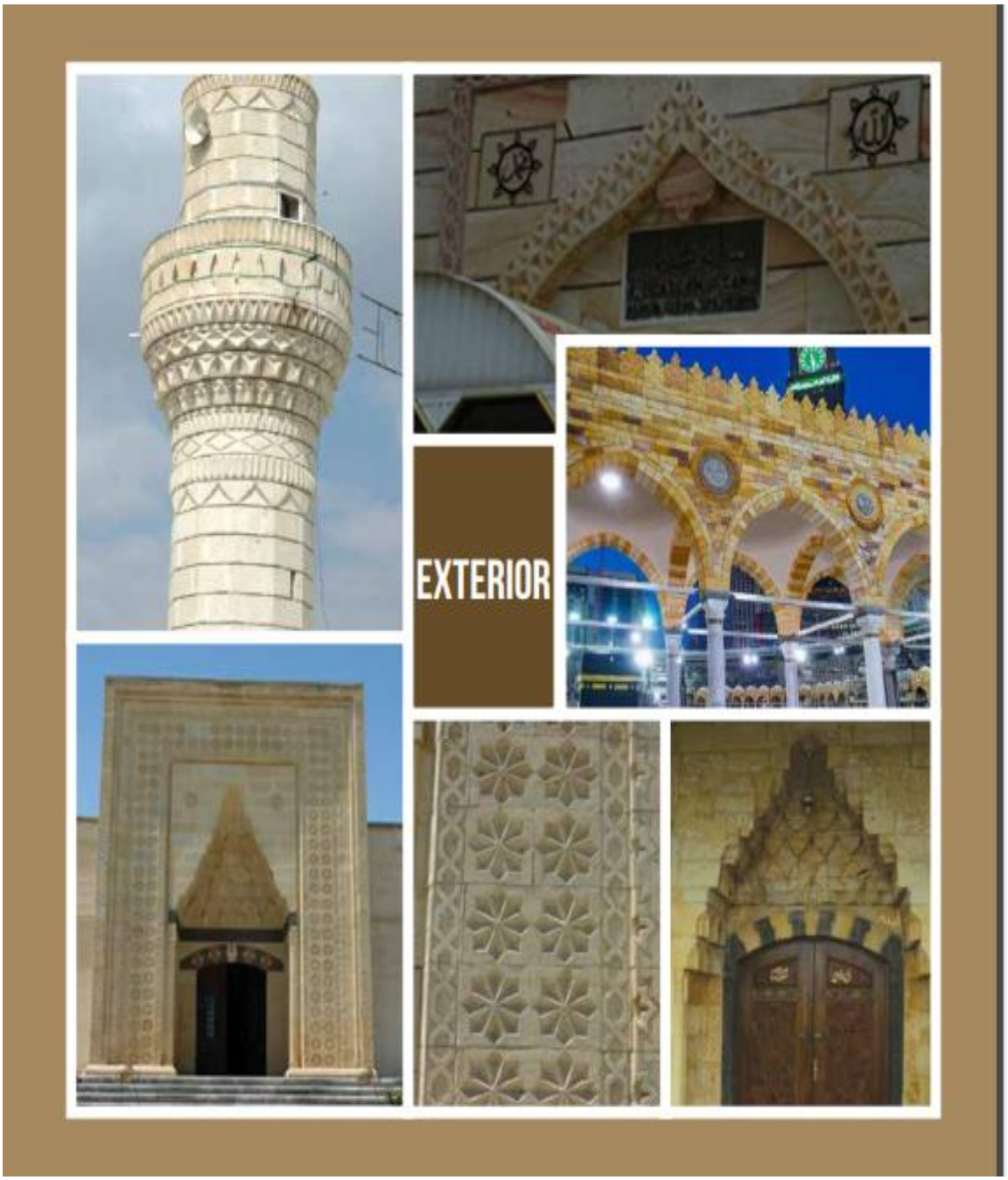


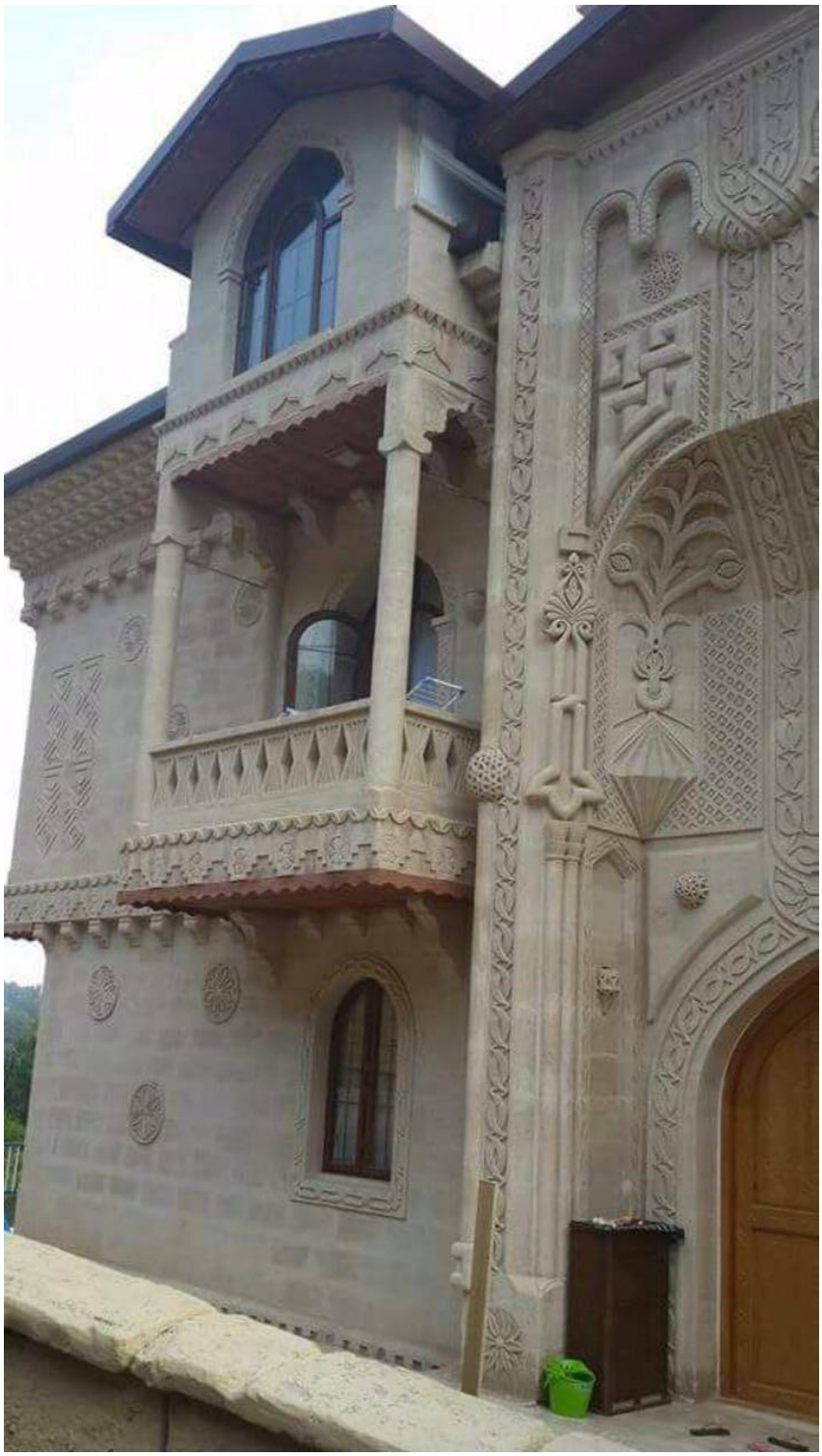
Eyüp Sultan Camii

Wonder Stones used in Mecca's Copullas & various types of building projects


BUILDINGS

INTERIOR


EXTERIOR



White

Camelhair

Black Cherry

Rosedried

Tattletale Gray

Formica

Colored

WONDER STONES SAMPLE

WONDER STONES SAMPLE

WONDER STONES SAMPLE

WONDER STONES SAMPLE

WONDER STONES SAMPLE

LAB TEST
AND
PHYSICAL-
MECHANICAL PROPERTIES OF
WONDER STONES

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PHYSICO-MECHANICAL PROPERTIES OF
DESERT YELLOW

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PHYSICO-MECHANICAL PROPERTIES OF "DESERT YELLOW"

Hardness	(Mohs)	2
Schmidt hardness		13
Dry unit volume weight, (density)	(gr/cm^3)	1.087
Specific gravity of solid part	(gr/cm^3)	2.5
Water Absorption at atmospheric pressure by weight	(%)	39.34
Water Absorption at atmospheric pressure by volume (apparent porosity)	(%)	42.77
Real porosity, (total porosity)	(%)	56.5
Compressive strength	(kg/cm^2)	25-30 (2-3 N/mm^2)
Flexural (bending) strength	(kg/cm^2)	75 (7 N/mm^2)
P-Wave velocity	(m/s)	1500-2100
P-Wave velocity decrease after freezing,	(%)	6.1
Frost resistance (Loss of weight)	(%)	0.64 No sign of alteration
Strength decrease after freezing	(%)	5.2
Resistance to wear by abrasion, Böhme method DIN 52108	(cm^3/50cm^2)	92
Thermal conductivity, k (λ)	W/mK	0.25

THE COMMERCIAL NAME OF THE STONE: **DESERT YELLOW**

THE COUNTRY AND REGION OF EXTRACTION: **Nevşehir province of TURKEY**

THE NAME OF SUPPLIER: **BOLTAS MINING and BUILDING MATERIALS TRADE LTD. COMPANY**

Prof.Dr.H. Tarık ÖZKAHRAMAN
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The average unit volume weight of **DESERT YELLOW** is found to be 1.087 gr/cm^3 which is lower than the minimum Standard value of 2.55 gr/cm^3.

The total porosity of **DESERT YELLOW** is 56.5 percent. And apparent porosity of **DESERT YELLOW** is 42.77 percent.

The water absorption by weight under atmospheric pressure of **DESERT YELLOW** is 39.34 % which is higher than maximum Standard value of 7.5%.

Uniaxial Compressive Strength of **DESERT YELLOW** on average is 2-3 N/mm^2 which is lower than the minimum Standard value of 30 N/mm^2 for facing Stones which are used for external wall cladding.

Flexural (Bending) Strength of **DESERT YELLOW** is 7 N/mm^2 which is higher than the minimum Standard value of 6 N/mm^2.

Frost resistance (Loss of weight) is 0.64 % which is lower than maximum Standard value of 1%. Also no sign of alteration is observed.

Compressive strength decrease after freezing is 5.2 % which is equal to maximum Standard value of 5 %.

Resistance to wear by abrasion (The Böhme test carried out according to DIN 52108) is 92 cm^3/50cm^2 which is higher than Standard value of 25 cm^3/50cm^2 for facing Stones.

Conclusion: DESERT YELLOW is a volcanic rock and it has high porosity of 56.5 % and therefore it's a good heat insulator rock. Only the flexural (bending) strength and frost resistance of DESERT YELLOW are compatible with standards for external wall cladding in buildings.

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To whom it may concern;

The physico-mechanical analysis on **DESERT YELLOW** is carried out according to the specifications laid out in;

EUROPEAN STANDARD EN 1342: Standard for natural facing (External Cladding) stones
EN 1341 and 1343: Kerbs of natural Stone for external paving
TS 10449 (Equivalent Turkish Standard) for natural Stones for natural facing and external paving

EUROPEAN STANDARD EN 1936 Natural stone test methods – Determination of real density and apparent density, and of total and open porosity

EUROPEAN STANDARD EN 1925 Determination of water absorption.

EUROPEAN STANDARD EN 1926 Determination of compressive strength.

EUROPEAN STANDARD EN 12371 Determination of frost resistance

EUROPEAN STANDARD EN 12372 Determination of flexural strength

EUROPEAN STANDARD EN 12407 Petrographic examination

EUROPEAN STANDARD prEN 14146 Determination of the dynamic modulus of elasticity by P-wave velocity

DEUTSCHE NORM DIN 52 104 Testing of natural stone Freeze-thaw cyclic test.

ASTM DESIGNATION C 97-99 The American Society for testing and Materials. Determination of natural stone properties.

TURKISH STANDARD T.S.E (Standard institution of Turkey) 699-1910-2513-10449 and TS 10449/T1. For natural stones

The date of testing: 09-02-2009

Prof. H. Tarik Özkahraman

The name and address of the test laboratory:
Marble Research Group, Department of Mining Engineering.
Address:
The University of Suleyman Demirel, SDU., ISPARTA, Turkey

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PHYSICO-MECHANICAL PROPERTIES OF "ASMALI GREY"

Hardness	(Mohs)	3
Schmidt hardness		31
Dry unit volume weight, (density)	(gr/cm^3)	1.711
Specific gravity of solid part	(gr/cm^3)	2.545
Water Absorption at atmospheric pressure by weight	(%)	14.27
Water Absorption at atmospheric pressure by volume (apparent porosity)	(%)	24.40
Real porosity, (total porosity)	(%)	32.8
Compressive strength	(kg/cm^2)	340-400 (34-40 N/mm^2)
Flexural (bending) strength	(kg/cm^2)	70 (7 N/mm^2)
P-Wave velocity	(m/s)	1800-2100
P-Wave velocity decrease after freezing,	(%)	4.2
Frost resistance (Loss of weight)	(%)	0.19 No sign of alteration
Strength decrease after freezing	(%)	4.05
Resistance to wear by abrasion, Böhme method DIN 52108	(cm^3/50cm^2)	36.3
Thermal conductivity, k (λ)	W/mK	0.51

THE COMMERCIAL NAME OF THE STONE: **ASMALI GREY**

THE COUNTRY AND REGION OF EXTRACTION: **Nevşehir province of TURKEY**

THE NAME OF SUPPLIER: **BOLTAS MINING and BUILDING MATERIALS TRADE LTD. COMPANY**

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The average unit volume weight of **ASMALI GREY** is found to be 1.711 gr/cm^3 which is lower than the minimum Standard value of 2.55 gr/cm^3.

The total porosity of **ASMALI GREY** is 32.8 percent. And apparent porosity of **ASMALI GREY** is 24.40 percent.

The water absorption by weight under atmospheric pressure of **ASMALI GREY** is 14.27 % which is higher than maximum Standard value of 7.5%.

Uniaxial Compressive Strength of **ASMALI GREY** on average is 34-40 N/mm^2 which is higher than the minimum Standard value of 30 N/mm^2 for facing Stones which are used for external wall cladding.

Flexural (Bending) Strength of **ASMALI GREY** is 7 N/mm^2 which is higher than the minimum Standard value of 6 N/mm^2.

Frost resistance (Loss of weight) is 0.19 % which is lower than maximum standard value of 1%. Also no sign of alteration is observed.

Compressive strength decrease after freezing is 4.05 % which is lower than maximum standard value of 5%. Therefore it satisfies the standard.

Resistance to wear by abrasion (The Böhme test carried out according to DIN 52108) is 36.3 cm^3/50cm^2 which is more than Standard value of 25 cm^3/50cm^2 for facing Stones.

Thermal Conductivity: The thermal conductivity coefficient k is equal to 0,51 W/m.K. So, it saves heat energy due to its heat insulation property.

Conclusion: ASMALI GREY is a volcanic rock and it has high porosity of 32.8 % and it's a good heat insulator rock. The Uniaxial Compressive Strength, Flexural (Bending) Strength, and Frost resistance and strength decrease after freezing and thawing of ASMALI GREY are compatible with standards for external wall cladding in buildings.

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The physico-mechanical analysis on **ASMALI GREY** is carried out according to the specifications laid out in;

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PHYSICO-MECHANICAL PROPERTIES OF
ERCIYES DARK

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The average unit volume weight of **ERCIYES DARK** is found to be 1.200 gr/cm^3 which is higher than the minimum Standard value of 2.453 gr/cm^3.

The total porosity of **ERCIYES DARK** is 51.1 percent. And apparent porosity of **ERCIYES DARK** is 37.56 percent.

The water absorption by weight under atmospheric pressure of **ERCIYES DARK** is 31.30 % which is higher than maximum Standard value of 7.5%.

Uniaxial Compressive Strength of **ERCIYES DARK** on average is 6-11 N/mm^2 which is lower than the minimum Standard value of 30 N/mm^2 for facing Stones which are not used for external wall cladding.

Flexural (Bending) Strength of **ERCIYES DARK** is 5 N/mm^2 which is lower than the minimum Standard value of 6 N/mm^2.

Frost resistance (Loss of weight) is 0.55 % which is lower than maximum Standard value of 1%. Also no sign of alteration is observed.

Compressive strength decrease after freezing is 3.95 % which is lower than maximum Standard value of 5 %.

Resistance to wear by abrasion (The Böhme test carried out according to DIN 52108) is 89.3 cm^3/50cm^2 which is more than Standard value of 25 cm^3/50cm^2 for facing Stones.

Conclusion: ERCIYES DARK is a volcanic rock and it has high porosity of 51.1 % and therefore it's a good heat insulator rock. The frost resistance and compressive strength decrease after freezing of ERCIYES DARK are compatible with standards for external wall cladding in buildings.

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PHYSICO-MECHANICAL PROPERTIES OF "ERCIYES DARK"

Hardness	(Mohs)	2-3
Schmidt hardness		19
Dry unit volume weight, (density)	(gr/cm^3)	1.200
Specific gravity of solid part	(gr/cm^3)	2.453
Water absorption at atmospheric pressure by weight	(%)	31.30
Water absorption at atmospheric pressure by volume (apparent porosity)	(%)	37.56
Real porosity, (total porosity)	(%)	51.1
Compressive strength	(kg/cm^2)	65-110 (6-11 N/mm^2)
Flexural (bending) strength	(kg/cm^2)	50 (5 N/mm^2)
P-Wave velocity	(m/s)	2000-2500
P-Wave velocity decrease after freezing,	(%)	4.1
Frost resistance (Loss of weight)	(%)	0.55 No sign of alteration
Strength decrease after freezing	(%)	3.95
Resistance to wear by abrasion, Böhme method DIN 52108	(cm^3/50cm^2)	89.3
Thermal conductivity, k (λ)	W/mK	0.30

THE COMMERCIAL NAME OF THE STONE: **ERCIYES DARK**

THE COUNTRY AND REGION OF EXTRACTION: **Nevşehir province of TURKEY**

THE NAME OF SUPPLIER: **BOLTAS MINING and BUILDING MATERIALS TRADE LTD. COMPANY**

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PHYSICO-MECHANICAL PROPERTIES OF
ANTIQUE BROWN

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The average unit volume weight of **ANTIQUE BROWN** is found to be 1.715 gr/cm^3 which is lower than the minimum Standard value of 2.55 gr/cm^3.

The total porosity of **ANTIQUE BROWN** is 32.7 percent. And apparent porosity of **ANTIQUE BROWN** is 22.74 percent.

The water absorption by weight under atmospheric pressure of **ANTIQUE BROWN** is 13.26 % which is higher than maximum Standard value of 7.5%.

Uniaxial Compressive Strength of **ANTIQUE BROWN** on average is 37-52 N/mm^2 which is higher than the minimum Standard value of 30 N/mm^2 for facing Stones which are used for external wall cladding.

Flexural (Bending) Strength of **ANTIQUE BROWN** is 11 N/mm^2 which is higher than the minimum Standard value of 6 N/mm^2.

Frost resistance (Loss of weight) is 0.24 % which is lower than maximum Standard value of 1%. Also no sign of alteration is observed.

Compressive strength decrease after freezing is 4 % which is lower than maximum Standard value of 5 %.

Resistance to wear by abrasion (The Böhme test carried out according to DIN 52108) is 18 cm^3/50cm^2 which is less than Standard value of 25 cm^3/50cm^2 for facing Stones.

Conclusion: ANTIQUE BROWN is a volcanic rock and it has high porosity of 32.7 % and therefore it's a good heat insulator rock.The average unit volume weight, Uniaxial Compressive Strength, Flexural (Bending) Strength, Frost resistance, Compressive strength decrease after freezing and Resistance to wear by abrasion of ANTIQUE BROWN are compatible with standards for external wall cladding in buildings. Therefore it can be used for external wall cladding.

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PHYSICO-MECHANICAL PROPERTIES OF "ANTIQUE BROWN"

Hardness	(Mohs)	3
Schmidt hardness		23
Dry unit volume weight, (density)	(gr/cm^3)	1.715
Specific gravity of solid part	(gr/cm^3)	2.549
Water Absorption at atmospheric pressure by weight	(%)	13.26
Water Absorption at atmospheric pressure by volume (apparent porosity)	(%)	22.74
Real porosity, (total porosity)	(%)	32.7
Compressive strength	(kg/cm^2)	370-520 (37-52 N/mm^2)
Flexural (bending) strength	(kg/cm^2)	110 (11 N/mm^2)
P-Wave velocity	(m/s)	3000
P-Wave velocity decrease after freezing,	(%)	3.6
Frost resistance (Loss of weight)	(%)	0.24 No sign of alteration
Strength decrease after freezing	(%)	4
Resistance to wear by abrasion, Böhme method DIN 52108	(cm^3/50cm^2)	18
Thermal conductivity, k (λ)	W/mK	0.50

THE COMMERCIAL NAME OF THE STONE: **ANTIQUE BROWN**

THE COUNTRY AND REGION OF EXTRACTION: **Nevşehir province of TURKEY**

THE NAME OF SUPPLIER: **BOLTAS MINING and BUILDING MATERIALS TRADE LTD. COMPANY**

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PHYSICO-MECHANICAL PROPERTIES OF
CAPPADOCCIAN ROSE

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The average unit volume weight of **CAPPADOCCIAN ROSE** is found to be 1.5164 gr/cm^3 which is higher than the minimum Standard value of 2.453 gr/cm^3.

The total porosity of **CAPPADOCCIAN ROSE** is 43.3 percent. And apparent porosity of **CAPPADOCCIAN ROSE** is 23.10 percent.

The water absorption by weight under atmospheric pressure of **CAPPADOCCIAN ROSE** is 15.21 % which is higher than maximum Standard value of 7.5%.

Uniaxial Compressive Strength of **CAPPADOCCIAN ROSE** on average is 9-10 N/mm^2 which is lower than the minimum Standard value of 30 N/mm^2 for facing Stones which are not used for external wall cladding.

Flexural (Bending) Strength of **CAPPADOCCIAN ROSE** is 6 N/mm^2 which is same the minimum Standard value of 6 N/mm^2.

Frost resistance (Loss of weight) is 0.53 % which is lower than maximum Standard value of 1%. Also no sign of alteration is observed.

Compressive strength decrease after freezing is 5.40 % which is approximately equal to maximum Standard value of 5 %.

Resistance to wear by abrasion (The Böhme test carried out according to DIN 52108) is 32.3 cm^3/50cm^2 which is more than Standard value of 25 cm^3/50cm^2 for facing Stones.

Conclusion: CAPPADOCCIAN ROSE is a volcanic rock and it has high porosity of 43.3 % and therefore it's a good heat insulator rock.The average unit volume weight, Uniaxial Compressive Strength, Flexural (Bending) Strength, Frost resistance and Resistance to wear by abrasion of CAPPADOCCIAN ROSE are compatible with standards for external wall cladding in buildings. Therefore it can be used for external wall cladding.

Prof.Dr.H. Tarik ÖZKAHRAMAN
S. D. Ü. Müh. - Mim. Fakültesi
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Süleyman Demirel University
Mining Engineering Department - Marble Research Group
32260 ISPARTA / TURKEY
Tel : 0 246 2370856 – 2371199 Fax : 0 246 2370859

PHYSICO-MECHANICAL PROPERTIES OF "CAPPADOCCIAN ROSE"

Hardness	(Mohs)	2
Schmidt hardness		12
Dry unit volume weight, (density)	(gr/cm^3)	1.5164
Specific gravity of solid part	(gr/cm^3)	2.674
Water Absorption at atmospheric pressure by weight	(%)	15.21
Water Absorption at atmospheric pressure by volume (apparent porosity)	(%)	23.10
Real porosity, (total porosity)	(%)	43.3
Compressive strength	(kg/cm^2)	90-95 (6-11 N/mm^2)
Flexural (bending) strength	(kg/cm^2)	60 (6 N/mm^2)
P-Wave velocity	(m/s)	2000-2400
P-Wave velocity decrease after freezing,	(%)	3.9
Frost resistance (Loss of weight)	(%)	0.53 No sign of alteration
Strength decrease after freezing	(%)	5.40
Resistance to wear by abrasion, Böhme method DIN 52108	(cm^3/50cm^2)	32.3
Thermal conductivity, k (λ)	W/mK	0.35

THE COMMERCIAL NAME OF THE STONE: **CAPPADOCCIAN ROSE**

THE COUNTRY AND REGION OF EXTRACTION: **Nevşehir province of TURKEY**

THE NAME OF SUPPLIER: **BOLTAS MINING and BUILDING MATERIALS TRADE LTD. COMPANY**

Prof.Dr.H. Tarik ÖZKAHRAMAN
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To whom it may concern;

The physico-mechanical analysis on **CAPPADOCCIAN ROSE** is carried out according to the specifications laid out in;

EUROPEAN STANDARD EN 1342: Standard for natural facing (External Cladding) stones
EN 1341 and 1343: Kerbs of natural Stone for external paving
TS 10449 (Equivalent Turkish Standard) for natural Stones for natural facing and external paving

EUROPEAN STANDARD EN 1936 Natural stone test methods – Determination of real density and apparent density, and of total and open porosity

EUROPEAN STANDARD EN 1925 Determination of water absorption.

EUROPEAN STANDARD EN 1926 Determination of compressive strength.

EUROPEAN STANDARD EN 12371 Determination of frost resistance

EUROPEAN STANDARD EN 12372 Determination of flexural strength

EUROPEAN STANDARD EN 12407 Petrographic examination

EUROPEAN STANDARD prEN 14146 Determination of the dynamic modulus of elasticity by P-wave velocity

DEUTSCHE NORM DIN 52 104 Testing of natural stone Freeze-thaw cyclic test.

ASTM DESIGNATION C 97-99 The American Society for testing and Materials. Determination of natural stone properties.

TURKISH STANDARD T.S.E (Standard institution of Turkey) 699-1910-2513-10449 and TS 10449/T1. For natural stones

The date of testing: 09-02-2009

Prof. H. Tarik Ozkahraman

The name and address of the test laboratory:
Marble Research Group, Department of Mining Engineering.
Address:
The University of Suleyman Demirel, SDU.,
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BOLTAS MINING and BUILDING MATERIALS TRADE LTD. COMPANY

PHYSICO-MECHANICAL PROPERTIES OF
ROCK OF GÖREME

Address:
Nevşehir Organize Sanayi Bölgesi yanı,
Aksaray yolu 13. km NEVŞEHİR
Tel: 03842429220, Fax: 03842429223
E-Mail: boltas@boltas-stone.com

Süleyman Demirel University
Mining Engineering Department - Marble Research Group
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Tel : 0 246 2370856 – 2371199 Fax : 0 246 2370859

PHYSICO-MECHANICAL PROPERTIES OF "ROCK OF GÖREME"

Hardness	(Mohs)	3
Schmidt hardness		12
Dry unit volume weight, (density)	(gr/cm^3)	1.42
Specific gravity of solid part	(gr/cm^3)	2.58
Water absorption at atmospheric pressure by weight	(%)	17.00
Water absorption at atmospheric pressure by volume (apparent porosity)	(%)	24.14
Real porosity, (total porosity)	(%)	45.0
Compressive strength	(kg/cm^2)	102 (10 N/mm^2)
Flexural (bending) strength	(kg/cm^2)	72 (7 N/mm^2)
P-Wave velocity	(m/s)	2400
P-Wave velocity decrease after freezing.	(%)	4.2
Frost resistance (Loss of weight)	(%)	0.5 No sign of alteration
Strength decrease after freezing	(%)	4.09
Resistance to wear by abrasion, Böhme method DIN 52108	(cm^3/50cm^2)	38
Thermal conductivity, k (λ)	W/mK	0.37

THE COMMERCIAL NAME OF THE STONE: **ROCK OF GÖREME**

THE COUNTRY AND REGION OF EXTRACTION: **Nevşehir province of TURKEY**

THE NAME OF SUPPLIER: **BOLTAS MINING and BUILDING MATERIALS TRADE LTD. COMPANY**

Prof.Dr.H. Tarık ÖZKAHRAMAN
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The average unit volume weight of **ROCK OF GOREME** is found to be 1.42 gr/cm^3 which is lower than the minimum Standard value of 2.55 gr/cm^3.

The total porosity of **ROCK OF GOREME** is 45 percent. And apparent porosity of **ROCK OF GOREME** is 24.14 percent.

The water absorption by weight under atmospheric pressure of **ROCK OF GOREME** is 17 % which is higher than maximum Standard value of 7.5%.

Uniaxial Compressive Strength of **ROCK OF GOREME** on average is 10 N/mm^2 which is lower than the minimum Standard value of 30 N/mm^2 for facing Stones which are used for external wall cladding.

Flexural (Bending) Strength of **ROCK OF GOREME** is 7 N/mm^2 which is higher than the minimum Standard value of 6 N/mm^2.

Frost resistance (Loss of weight) is 0.5 % which is lower than maximum Standard value of 1%. Also no sign of alteration is observed.

Compressive strength decrease after freezing is 4.09 % which is lower than maximum Standard value of 5 %..

Resistance to wear by abrasion (The Böhme test carried out according to DIN 52108) is 38 cm^3/50cm^2 which is higher than Standard value of 25 cm^3/50cm^2 for facing Stones.

Conclusion: ROCK OF GOREME is a volcanic rock and it has high porosity of 45 % and therefore it's a good heat insulator rock. Only the flexural (bending) strength, frost resistance and Compressive strength decrease after freezing of ROCK OF GOREME are compatible with standards for external wall cladding in buildings.

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To whom it may concern;

The physico-mechanical analysis on **ROCK OF GOREME** is carried out according to the specifications laid out in;

EUROPEAN STANDARD EN 1342: Standard for natural facing (External Cladding) stones
EN 1341 and 1343: Kerbs of natural Stone for external paving
TS 10449 (Equivalent Turkish Standard) for natural Stones for natural facing and external paving

EUROPEAN STANDARD EN 1936 Natural stone test methods – Determination of real density and apparent density, and of total and open porosity

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EUROPEAN STANDARD EN 12371 Determination of frost resistance

EUROPEAN STANDARD EN 12372 Determination of flexural strength

EUROPEAN STANDARD EN 12407 Petrographic examination

EUROPEAN STANDARD prEN 14146 Determination of the dynamic modulus of elasticity by P-wave velocity

DEUTSCHE NORM DIN 52 104 Testing of natural stone Freeze-thaw cyclic test.

ASTM DESIGNATION C 97-99 The American Society for testing and Materials. Determination of natural stone properties.

TURKISH STANDARD T.S.E (Standard institution of Turkey) 699-1910-2513-10449 and TS 10449/T1. For natural stones

The date of testing: 09-02-2009

Prof. H. Tarik Ozkahraman

The name and address of the test laboratory:
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Address:
The University of Suleyman Demirel, SDU.,
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BOLTAS MINING and BUILDING MATERIALS TRADE LTD. COMPANY

PHYSICO-MECHANICAL PROPERTIES OF
RED AND BEYOND

Address:
Nevşehir Organize Sanayi Bölgesi yanı,
Aksaray yolu 13. km NEVŞEHİR
Tel: 03842429220, Fax: 03842429223
E-Mail: boltas@boltas-stone.com

The average unit volume weight of **RED AND BEYOND** is found to be 1.730 gr/cm^3 which is higher than the minimum Standard value of 2.55 gr/cm^3.

The total porosity of **RED AND BEYOND** is 33.2 percent. And apparent porosity of **RED AND BEYOND** is 28.55 percent.

The water absorption by weight under atmospheric pressure of **RED AND BEYOND** is 16.50 % which is higher than maximum Standard value of 7.5%.

Uniaxial Compressive Strength of **RED AND BEYOND** on average is 38-47 N/mm^2 which is higher than the minimum Standard value of 30 N/mm^2 for facing Stones which are used for external wall cladding.

Flexural (Bending) Strength of **RED AND BEYOND** is 11 N/mm^2 which is higher than the minimum Standard value of 6 N/mm^2.

Frost resistance (Loss of weight) is 0.21 % which is lower than maximum Standard value of 1%. Also no sign of alteration is observed.

Compressive strength after freezing is 4.1 % which is lower than maximum Standard value of 5 %.

Resistance to wear by abrasion (The Böhme test carried out according to DIN 52108) is 27 cm^3/50cm^2 which is more than Standard value of 25 cm^3/50cm^2 for facing Stones.

Conclusion: RED AND BEYOND is a volcanic rock and it has high porosity of 33.2 % and therefore it's a good heat insulator rock. The Uniaxial Compressive Strength, Flexural (Bending) Strength, Frost resistance, Compressive strength after freezing and Resistance to wear by abrasion of RED AND BEYOND are compatible with standards for external wall cladding in buildings. Therefore it can be used for external wall cladding.

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32260 ISPARTA / TURKEY

Tel : 0 246 2370856 – 2371199 Fax : 0 246 2370859

PHYSICO-MECHANICAL PROPERTIES OF "RED AND BEYOND"

Hardness	(Mohs)	3
Schmidt hardness		24
Dry unit volume weight, (density)	(gr/cm^3)	1.730
Specific gravity of solid part	(gr/cm^3)	2.590
Water Absorption at atmospheric pressure by weight	(%)	16.50
Water Absorption at atmospheric pressure by volume (apparent porosity)	(%)	28.55
Real porosity, (total porosity)	(%)	33.2
Compressive strength	(kg/cm^2)	380-470 (38-47 N/mm^2)
Flexural (bending) strength	(kg/cm^2)	110 (11 N/mm^2)
P-Wave velocity	(m/s)	2700
P-Wave velocity decrease after freezing,	(%)	3.5
Frost resistance (Loss of weight)	(%)	0.21 No sign of alteration
Strength decrease after freezing	(%)	4.1
Resistance to wear by abrasion, Böhme method DIN 52108	(cm^3/50cm^2)	27
Thermal conductivity, k (λ)	W/mK	0.47

THE COMMERCIAL NAME OF THE STONE: **RED AND BEYOND**

THE COUNTRY AND REGION OF EXTRACTION: **Nevşehir province of TURKEY**

THE NAME OF SUPPLIER: **BOLTAS MINING and BUILDING MATERIALS TRADE LTD. COMPANY**

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To whom it may concern;

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EUROPEAN STANDARD EN 12371 Determination of frost resistance

EUROPEAN STANDARD EN 12372 Determination of flexural strength

EUROPEAN STANDARD EN 12407 Petrographic examination

EUROPEAN STANDARD prEN 14146 Determination of the dynamic modulus of elasticity by P-wave velocity

DEUTSCHE NORM DIN 52 104 Testing of natural stone Freeze-thaw cyclic test.

ASTM DESIGNATION C 97-99 The American Society for testing and Materials. Determination of natural stone properties.

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The date of testing: 09-02-2009

Prof. H. Tarik Ozkahraman

The name and address of the test laboratory:
Marble Research Group, Department of Mining Engineering.
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BOLTAS MINING and BUILDING MATERIALS TRADE LTD. COMPANY

PHYSICO-MECHANICAL PROPERTIES OF
YELLOW WHITE

Address:
Nevşehir Organize Sanayi Bölgesi yanı,
Aksaray yolu 13. km NEVŞEHİR
Tel: 03842429220, Fax: 03842429223
E-Mail: boltas@boltas-stone.com

Süleyman Demirel University
Mining Engineering Department - Marble Research Group
32260 ISPARTA / TURKEY
Tel : 0 246 2370856 – 2371199 Fax : 0 246 2370859

PHYSICO-MECHANICAL PROPERTIES OF "YELLOW WHITE"

Hardness	(Mohs)	2-3
Schmidt hardness		7
Dry unit volume weight, (density)	(gr/cm^3)	1.371
Specific gravity of solid part	(gr/cm^3)	2.56
Water Absorption at atmospheric pressure by weight	(%)	20.00
Water Absorption at atmospheric pressure by volume (apparent porosity)	(%)	27.42
Real porosity, (total porosity)	(%)	46.5
Compressive strength	(kg/cm^2)	50-60 (5-6 N/mm^2)
Flexural (bending) strength	(kg/cm^2)	40 (4 N/mm^2)
P-Wave velocity	(m/s)	1900-2100
P-Wave velocity decrease after freezing,	(%)	6.0
Frost resistance (Loss of weight)	(%)	0.77 No sign of alteration
Strength decrease after freezing	(%)	5.0
Resistance to wear by abrasion, Böhme method DIN 52108	($cm^3/50cm^2$)	49.8
Thermal conductivity, k (λ)	W/mK	0.39

THE COMMERCIAL NAME OF THE STONE: **YELLOW WHITE**

THE COUNTRY AND REGION OF EXTRACTION: **Nevşehir province of TURKEY**

THE NAME OF SUPPLIER: **BOLTAS MINING and BUILDING MATERIALS TRADE LTD. COMPANY**

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The average unit volume weight of **YELLOW WHITE** is found to be 1.371 gr/cm^3 which is lower than the minimum Standard value of 2.55 gr/cm^3.

The total porosity of **YELLOW WHITE** is 46.5 percent. And apparent porosity of **YELLOW WHITE** is 27.42 percent.

The water absorption by weight under atmospheric pressure of **YELLOW WHITE** is 20.0 % which is higher than maximum Standard value of 7.5%.

Uniaxial Compressive Strength of **YELLOW WHITE** on average is 5-6 N/mm^2 which is lower than the minimum Standard value of 30 N/mm^2 for facing Stones which are used for external wall cladding.

Flexural (Bending) Strength of **YELLOW WHITE** is 4 N/mm^2 which is lower than the minimum Standard value of 6 N/mm^2.

Frost resistance (Loss of weight) is 0.77 % which is lower than maximum Standard value of 1%. Also no sign of alteration is observed.

Compressive strength decrease after freezing is 5 % which is equal to the maximum Standard value of 5 %.

Resistance to wear by abrasion (The Böhme test carried out according to DIN 52108) is 49.8 $cm^3/50cm^2$ which is higher than Standard value of 25 $cm^3/50cm^2$ for facing Stones.

Conclusion: YELLOW WHITE is a volcanic rock and it has high porosity of 46.5 % and therefore it's a good heat insulator rock. Only the frost resistance of YELLOW WHITE is compatible with standards for external wall cladding in buildings. But, it is too soft to be a cladding stone. According to standards it can not be used as cladding stone outside buildings.

Prof.Dr.H. Tarık ÖZKAHRAMAN
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To whom it may concern;

The physico-mechanical analysis on **YELLOW WHITE** is carried out according to the specifications laid out in;

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EUROPEAN STANDARD prEN 14146 Determination of the dynamic modulus of elasticity by P-wave velocity

DEUTSCHE NORM DIN 52 104 Testing of natural stone Freeze-thaw cyclic test.

ASTM DESIGNATION C 97-99 The American Society for testing and Materials. Determination of natural stone properties.

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The date of testing: 09-02-2009

Prof. H. Tarik Ozkahraman

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HACETTEPE ÜNİVERSİTESİ
MADEN MÜHENDİSLİĞİ BÖLÜMÜ
KAYA MEKANİĞİ LABORATUVARI

BÖLTAŞ YAPI TAŞLARI TEKNİK ANALİZ SONUCU

STANDART ÖZELLİKLER		NEVŞEHİR SARI-BEYAZI (Yellow-White)	KAPADOKYA GÜLÛ (Capadocia Rose)	KAHVE MOZAİK (Brown Mosic)	ERCİYES KARASI (Erciyes Dark)	ASMALI GRİ (Asmalı Gray)	ÇÖL SARISI (Desert Yellow)	ANTİK KAHVE (Antique Brown)	KIZIL ÖTESİ (Red Beyond)	NOCHE TRAVERTEN (Noche Travertine)
Özgül Ağırlığı (Specific Gravity)		2.17	2.15	2.34	2.37	2.11	2.11	2.18	2.3	2.64
Birim Hacim Ağırlığı (Unit Volume Weight)		1.49	1.55	1.92	1.5	1.87	1.56	1.91	1.96	2.39
Su Emme (Water Absorbtion)	Kütlece (By Weight)	17.43%	17.44 %	7.76 %	19.7 %	11.24 %	18.72 %	12.59 %	11.20 %	2.02 %
	Hacimce (By Volume)	25.80%	26.28 %	14.85 %	29.51 %	20.65 %	29.20 %	23.95 %	21.94 %	4.79 %
Doluluk Oranı (Ratio Fullness)		68.50 %	72.07 %	82.18 %	63.35 %	88.67 %	74.18 %	87.60 %	85.15 %	90.53 %
Gözeneklilik (Porosity)		31.5%	27.93 %	17.82 %	36.65 %	11.33 %	25.82 %	12.40 %	14.85 %	9.47 %
Don Kaybı (Freezing and Thawing)		1.74%	0.78 %	0.07 %	0.10 %	0.14 %	1.48 %	0.59 %	0.44 %	0.09 %
Basınç Dayanımı (Compresive Strength)		350.6 kgf/cm^2	214.8 kgf/cm^2	264.8 kgf/cm^2	187.5 kgf/cm^2	388.57 kgf/cm^2	187.8 kgf/cm^2	293.5 kgf/cm^2	370.5 kgf/cm^2	426.7 kgf/cm^2
Eğilme Direnci (Strength to Bending)		91 kgf/cm^2	39.6 kgf/cm^2	53 kgf/cm^2	42.8 kgf/cm^2	51.6 kgf/cm^2	68.1 kgf/cm^2	69.1 kgf/cm^2	68.9 kgf/cm^2	63.7 kgf/cm^2
Darbe Dayanımı (Strength to Blow)		10.8 kg.cm/cm^3	16.8 kg.cm/cm^3	16.8 kg.cm/cm^3	20 kg.cm/cm^3	30.4 kg.cm/cm^3	12 kg.cm/cm^3	30 kg.cm/cm^3	16.8 kg.cm/cm^3	20 kg.cm/cm^3

Prof. Dr. Bahtiyar ÜNVER
H.Ü. Mühendislik Fakültesi
Dekan Yardımcısı

HACETTEPE ÜNİVERSİTESİ
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Kaya Mekaniği Laboratuvarı

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Fax: (312) (2992155)

	KAPADOKYA GÜLÜ (Cappadocia rose)	
Standart	TSE 699 Tabii Yapı Taşları- Muayene ve Deney Metotları (Methods of testing for natural building stones)	
Özgül ağırlığı (Specific gravity)	2.15	
Birim hacim ağırlığı (Unit volume weight)	1.55	
Su emme (Water absorption)		
Kütlece (by weight)	% 17.44	
Hacimce (by volume)	% 26.28	
Doluluk oranı (Ratio of fullness)	% 72.07	
Gözeneklilik derecesi (Porosity)	% 27.93	
Basınç dayanımı (Compressive strength)	214.8 kgf/cm²	21.08 MPa
Eğilme direnci (Strength to bending)	39.5 kgf/cm²	3.87 MPa
Darbe dayanımı (Strength to blow)	16.8 kg.cm/cm³	1.6 N.mm/mm³
Don kaybı (Freezing and thawing)	% 0.78	

B.

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	KIZIL ÖTESİ (Red beyond)	
Standart	TSE 699 Tabii Yapı Taşları- Muayene ve Deney Metotları (Methods of testing for natural building stones)	
Özgül ağırlığı (Specific gravity)	2.30	
Birim hacim ağırlığı (Unit volume weight)	1.96	
Su emme (Water absorption)		
Kütlece (by weight)	% 11.20	
Hacimce (by volume)	% 21.94	
Doluluk oranı (Ratio of fullness)	% 85.15	
Gözeneklilik derecesi (Porosity)	% 14.85	
Basınç dayanımı (Compressive strength)	370.5 kgf/cm²	36.35 MPa
Eğilme direnci (Strength to bending)	68.9 kgf/cm²	6.76 MPa
Darbe dayanımı (Strength to blow)	16.8 kg.cm/cm³	1.6 N.mm/mm³
Don kaybı (Freezing and thawing)	% 0.44	

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	NEVŞEHİR SARI-BEYAZI (Nevşehir yellow-white)	
Standart	TSE 699 Tabii Yapı Taşları- Muayene ve Deney Metotları (Methods of testing for natural building stones)	
Özgül ağırlığı (Specific gravity)	2.17	
Birim hacim ağırlığı (Unit volume weight)	1.49	
Su emme (Water absorption)		
Kütlece (by weight)	% 17.43	
Hacimce (by volume)	% 25.80	
Doluluk oranı (Ratio of fullness)	% 68.50	
Gözeneklilik derecesi (Porosity)	% 31.50	
Basınç dayanımı (Compressive strength)	350.6 kgf/cm²	34.40 MPa
Eğilme direnci (Strength to bending)	91.0 kgf/cm²	8.92 MPa
Darbe dayanımı (Strength to blow)	10.8 kg.cm/cm³	1.1 N.mm/mm³
Don kaybı (Freezing and thawing)	% 1.74	

B.

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Kaya Mekaniği Laboratuvarı

06800 Beytepe, Ankara
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Fax: (312) (2992155)

	ÇÖL SARISI (Desert yellow)	
Standart	TSE 699 Tabii Yapı Taşları- Muayene ve Deney Metotları (Methods of testing for natural building stones)	
Özgül ağırlığı (Specific gravity)	2.11	
Birim hacim ağırlığı (Unit volume weight)	1.56	
Su emme (Water absorption)		
Kütlece (by weight)	% 18.72	
Hacimce (by volume)	% 29.20	
Doluluk oranı (Ratio of fullness)	% 74.18	
Gözeneklilik derecesi (Porosity)	% 25.82	
Basınç dayanımı (Compressive strength)	187.8 kgf/cm²	18.42 MPa
Eğilme direnci (Strength to bending)	68.1 kgf/cm²	6.68 MPa
Darbe dayanımı (Strength to blow)	12.0 kg.cm/cm³	1.2 N.mm/mm³
Don kaybı (Freezing and thawing)	% 1.48	

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	KAHVE MOZAİK (Brown mosaic)	
Standart	TSE 699 Tabii Yapı Taşları-Muayene ve Deney Metotları (Methods of testing for natural building stones)	
Özgül ağırlığı (Specific gravity)	2.34	
Birim hacim ağırlığı (Unit volume weight)	1.92	
Su emme (Water absorption)		
Kütlece (by weight)	% 7.76	
Hacimce (by volume)	% 14.85	
Doluluk oranı (Ratio of fullness)	% 82.18	
Gözeneklilik derecesi (Porosity)	% 17.82	
Basınç dayanımı (Compressive strength)	264.8 kgf/cm^2	25.98 MPa
Eğilme direnci (Strength to bending)	53.0 kgf/cm^2	5.20 MPa
Darbe dayanımı (Strength to blow)	16.8 kg.cm/cm^3	1.6 N.mm/mm^3
Don kaybı (Freezing and thawing)	% 0.07	

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	ANTİK KAHVE (Antique brown)	
Standart	TSE 699 Tabii Yapı Taşları-Muayene ve Deney Metotları (Methods of testing for natural building stones)	
Özgül ağırlığı (Specific gravity)	2.18	
Birim hacim ağırlığı (Unit volume weight)	1.91	
Su emme (Water absorption)		
Kütlece (by weight)	% 12.59	
Hacimce (by volume)	% 23.95	
Doluluk oranı (Ratio of fullness)	% 87.60	
Gözeneklilik derecesi (Porosity)	% 12.40	
Basınç dayanımı (Compressive strength)	293.5 kgf/cm^2	28.80 MPa
Eğilme direnci (Strength to bending)	69.1 kgf/cm^2	6.78 MPa
Darbe dayanımı (Strength to blow)	30.0 kg.cm/cm^3	2.9 N.mm/mm^3
Don kaybı (Freezing and thawing)	% 0.59	

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	ERCİYES KARASI (Erciyes dark)	
Standart	TSE 699 Tabii Yapı Taşları-Muayene ve Deney Metotları (Methods of testing for natural building stones)	
Özgül ağırlığı (Specific gravity)	2.37	
Birim hacim ağırlığı (Unit volume weight)	1.50	
Su emme (Water absorption)		
Kütlece (by weight)	% 19.70	
Hacimce (by volume)	% 29.51	
Doluluk oranı (Ratio of fullness)	% 83.35	
Gözeneklilik derecesi (Porosity)	% 36.65	
Basınç dayanımı (Compressive strength)	187.5 kgf/cm^2	18.40 MPa
Eğilme direnci (Strength to bending)	42.8 kgf/cm^2	4.20 MPa
Darbe dayanımı (Strength to blow)	20.0 kg.cm/cm^3	2.0 N.mm/mm^3
Don kaybı (Freezing and thawing)	% 0.10	

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	ASMALI GRİ (Asmalı grey)	
Standart	TSE 699 Tabii Yapı Taşları-Muayene ve Deney Metotları (Methods of testing for natural building stones)	
Özgül ağırlığı (Specific gravity)	2.11	
Birim hacim ağırlığı (Unit volume weight)	1.87	
Su emme (Water absorption)		
Kütlece (by weight)	% 11.24	
Hacimce (by volume)	% 20.65	
Doluluk oranı (Ratio of fullness)	% 88.67	
Gözeneklilik derecesi (Porosity)	% 11.33	
Basınç dayanımı (Compressive strength)	388.7 kgf/cm^2	38.13 MPa
Eğilme direnci (Strength to bending)	51.6 kgf/cm^2	5.06 MPa
Darbe dayanımı (Strength to blow)	30.4 kg.cm/cm^3	3.0 N.mm/mm^3
Don kaybı (Freezing and thawing)	% 0.14	

Hacettepe University
Mining Engineering Faculty
Rock Mechanic Laboratories

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Böltaş Natural Stone
Aksaray Yolu 13.km
50100 Nevsehir / TURKEY

The company Böltaş Natural Stone had bring nine different colors volcanic natural stones. Physical and Mechanical experiments had done with the IS Standards TSE 699, Natural Stone Examination and Experiment Methodology. Each of the stones' result had given on the tables. The volcanic stones are specified in scientific literature Andesite, Tuff, and Tuffic Basalt. According to the result, these stones are suitable as a building material.

Regards

B. Ünver

Prof. Dr. Bahtiyar ÜNVER

HACETTEPE UNIVERSTY
Mining Engineering Faculty
Rock Mechanic Laboratories

BÖLTAŞ NATURAL STONE TECHNICAL ANALYSIS REPORT

STANDART ÖZELLİKLER		Yellow-White	Cappadocia Rose	Brown Mosic	Erciyes Dark	Asmali Grey	Desert Yellow	Antique Brown	Red Beyond	Noche Travertine
Specific Gravity		2.17	2.15	2.34	2.37	2.11	2.11	2.18	2.3	2.64
Unit Volume Weight		1.49	1.55	1.92	1.5	1.87	1.56	1.91	1.96	2.39
Water Absorption	By Weight	17.43%	17.44%	7.76%	19.70%	11.24%	18.72%	12.59%	11.20%	2.02%
	By Volume	25.80%	26.28%	14.85%	29.51%	20.65%	29.20%	23.95%	21.94%	4.79%
Ratio Fullness		68.50%	72.07%	82.18%	63.35%	88.67%	74.18%	87.60%	85.15%	90.53%
Porosity		31.50%	27.93%	17.82%	36.65%	11.33%	25.82%	12.40%	14.85%	9.47%
Freezing and Thawing		1.74%	0.78%	0.07%	0.10%	0.14%	1.48%	0.59%	0.44%	0.09%
Compresive Strength		350.6kgf/cm^2	214,8kgf/cm^2	264,8kgf/cm^2	187,5kgf/cm^2	388,7kgf/cm^2	187,8kgf/cm^2	293,5kgf/cm^2	370,5kgf/cm^2	426,7kgf/cm^2
Strength to Bending		91kgf/cm^2	39,5kgf/cm^2	53kgf/cm^2	42,8kgf/cm^2	51,6kgf/cm^2	68,1kgf/cm^2	69,1kgf/cm^2	68,9kgf/cm^2	63,7kgf/cm^2
Strength to Blow		10,8kg.cm/cm^3	16,8kg.cm/cm^3	16,8kg.cm/cm^3	20kg.cm/cm^3	30,4kg.cm/cm^3	12kg.cm/cm^3	30kg.cm/cm^3	16,8kg.cm/cm^3	20,0kg.cm/cm^3

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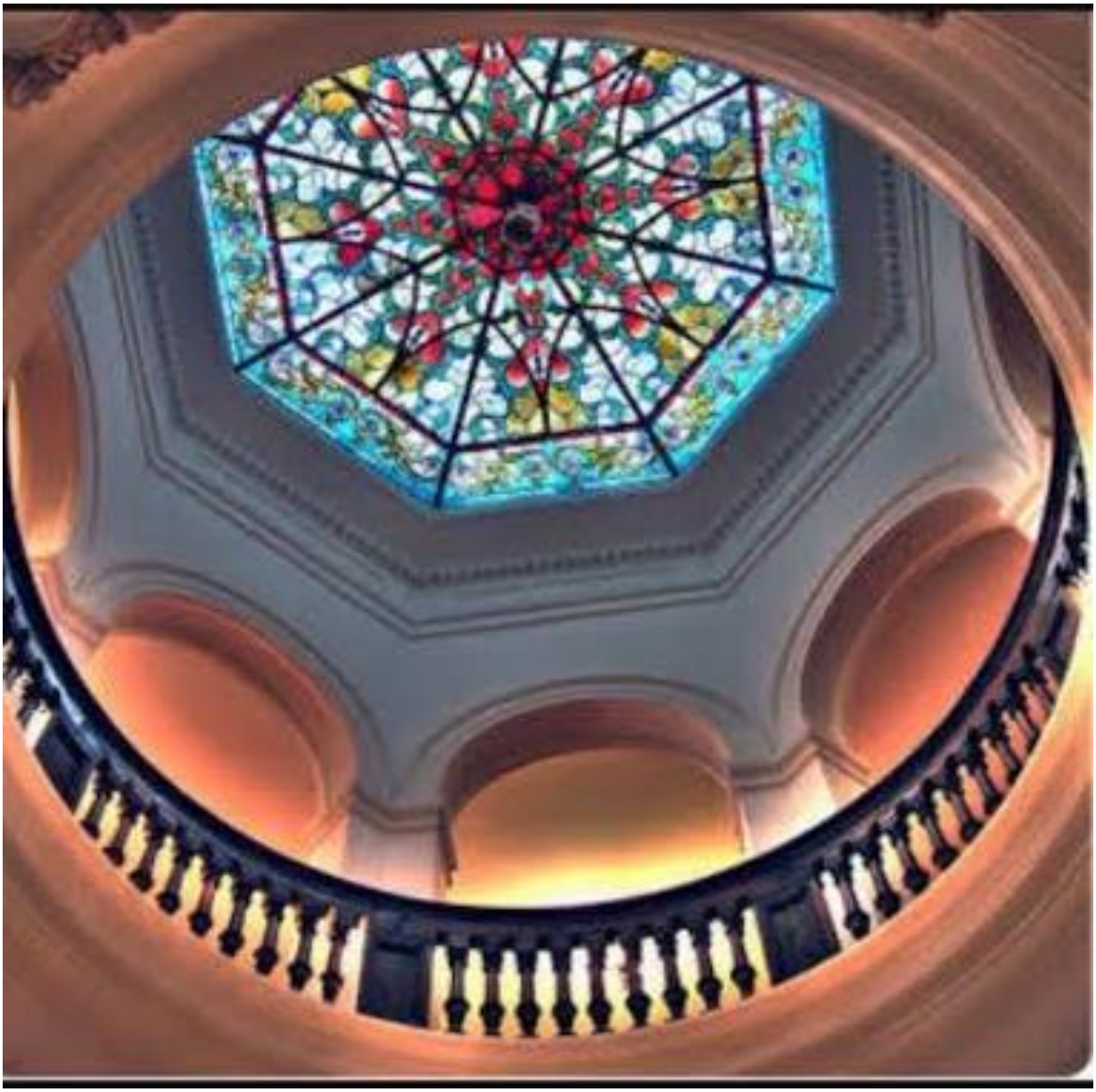

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Thank You

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