

ORDERER:

D.PT.U. "MIP - MARFIL" LTD PRILEP

ALEKSANDAR MAKEDONSKI STREET bb PRILEP

LOCATION / LOCATION OF THE MATERIAL

GJUROVO , municipality PRILEP

REPORT:

FROM THE PERFORMED TESTS FOR DETERMINATION OF THE PHYSICAL AND MECHANICAL CHARACTERISTICS OF ARCHITECTURAL AND DECORATIVE AND CONSTRUCTION AND TECHNICAL STONE.

TECHNICAL NUMBER OF THE REPORT:

AKK – 06/2013 – 353

DATE:

June 2013

INSTITUTE OF CONSTRUCTION

"MACEDONIA"(MAKEDONIJA) A.D.

Drezdenska Street №52, 1000 Skopje

Republic of Macedonia

Tel: 02 3066 816 | 02 3066 833

Fax: 02 3066 828

Web: www.gim.com.mk

e-mail: gim@gim.com.mk



Round seal from the Institute of Construction AD Skopje.

ORDERER:	D.P.T.U. "MIP-MARFIL" LTD PRILEP ALEKSANDAR MAKEDONSKI STREET bb PRILEP
ENFORCEMENT AGENT:	INSTITUTE OF CONSTRUCTION "MACEDONIA" A.D. SKOPJE DREZDENSKA STREET №52 Skopje
CONTENT:	REPORT OF PERFORMED TESTS OF THE ARCHITECTURAL AND DECORATIVE STONE AND CONSTRUCTION TECHNICAL STONE FROM LOCALITY GJUROVO , MUNICIPALITY PRILEP
RESPONSIBLE ENGINEER OF THE DEPARTMENT FOR AKK:	MIRJANA DALANOVIKJ , graduated construction engineer
ENFORCEMENT AGENT OF LABORATORY EXAMINATIONS AND OTHER COWORKERS	ZLATKO ILIEVSKI , graduated chemical engineer ALEKSANDRA NIKOLOVA , construction laboratory assistant OLIVERA PISLEVSKA, construction technician BORCHE PRANGOVSKI , construction laboratory assistant SRBOLJUB DEJANOVIKJ , v.k.v.m.
EXTERNAL COWORKER: MINERALOGICAL-PETROGRAPHIC ANALYSIS	GORICA STEFANOVA , graduated engineer geologist
OFFICE SUPPLIERS TECH.NUMBER:	SKOPJE AKK – 06/2013 - 353
HEAD OF DEPARTMENT: Illegible signature-Mirjana Dalanovikj Graduated construction engineer	LABORATORY'S DIRECTOR: Illegible signature-Gjorgi Gosev Graduated construction engineer
Skopje June 2013	

CONTENTS:

- INTRODUCTION WITH A PROGRAMME FOR TESTING..... page 4

- RESULTS OF PHYSICAL-MECHANICAL CHARACTERISTICS..... page 5

- SHORT CHEMICAL ANALYSIS page 6

- MINERALOGICAL-PETROGRAPHIC ANALYSIS..... page 6

- ANALYSIS OF THE RESULTS WITH AN OPINION FOR THE STONE USABILITY..... page 7

➤ INTRODUCTION:

THE LABORATORY OF THE INSTITUTE OF CONSTRUCTION "MACEDONIA" AD SKOPJE as specialized and authorized organization for testing and determining of the quality of the construction materials , on demand and for the needs of the firm D.P.T.U. "MIP-MARFIL" LTD PRILEP performed tests of the architectural and decorative stone and construction technical stone for internal and external use from LOCALITY GJUROVO, municipality PRILEP for identifying and determining the possibility of its implementation in architectural and construction purposes.

The rock samples were selected and processed in forms of testing by the Orderer of the test.

The performer of testing receives and takes samples, which after that are appropriately marked and allocated for the necessary tests. Upon request of the Orderer samples were tested according to the following program for testing.

PROGRAMME FOR TESTING:

I/ TESTS FOR DETERMINING OF THE PHYSICAL-MECHANICAL CHARACTERISTICS OF THE ARCHITECTURAL AND DECORATIVE STONE AND CONSTRUCTION TECHNICAL STONE FROM LOCALITY GJUROVO, municipality PRILEP.

1. STRENGTH OF THE STONE PRESSURE IN DRY CONDITION - MKS B.B8.012
2. STRENGTH OF THE STONE PRESSURE IN WATER SATURATED CONDITION - MKS B.B8.012
3. STRENGTH OF THE STONE PRESSURE AFTER 25 CYCLES OF FREEZING AND THAWING - MKS B.B8.012
4. WATER ABSORPTION - OF A STONE - MKS B.B8.010
5. ABRASION RESISTANCE OF STONE-(Böhme)-MKS B.B8.015

- 6.VOLUME WITH THE PORES AND CAVITIES OF THE STONE - MKS B.B8.032
7. VOLUME WITHOUT THE PORES AND CAVITIES OF THE STONE - MKS B.B8.032
- 8.COEFFICIENT OF THE VOLUME OF THE STONE- MKS B.B8.032
9. LEVEL OF DENSITY - MKS B.B8.032
- 10.POROSITY OF THE STONE – MKS B.B8.032
- 11.RESISTANCE TO FREEZING THE STONE-MKS B.B8.002
12. MINERALOGICAL-PETROGRAPHIC COMPOSITION OF A STONE – MKS B.B8.003

II/ PARTIAL CHEMICAL ANALYSIS OF A STONE – MKS B.B8.042

III/ MINERALOGICAL-PETROGRAPHIC COMPOSITION OF A STONE – MKS B.B8.003

The testing are made according to the MKS standards listed in the program for testing and the results are compared with the established criteria in the standards: MKS B.B2.009, MKS U.E 9.021, MKS U.E9.028, MKS U.E4.014 and MKS U.E 9.020

The results of the examinations as minimum, maximum and average values are presented in this Report.

I/ TABULAR PRESENTATION OF RESULTS OF DETERMINED PHYSICAL AND MECHANICAL CHARACTERISTICS OF ARCHITECTURAL AND DECORATIVE AND CONSTRUCTION AND TECHNICAL STONE-LOCALITY GJUROVO, MUNICIPALITY PRILEP

Ord №	Testing	Method according to MKS	Unit measure	Designation	Results of the testing	Conditions for Quality : BET/MK S B.B2.009 BNS/MKS U.E9.021/028 AB/MKS U.E4.014 TAMP/MKS U.E9.020
1	Strength of the pressure in dry condition	B.B8.012	MRa	β_p min	106,19	CONC/min.(80;160) BBL/min. (100) AC/min.(120,140;160) TAMP/min(100,120)
				β_p max	134,25	
				β_p mid	121,80	
2	Strength of the pressure in water saturated condition	B.B8.012	MRa	β_p min	103,45	CONC/min.(64;128) BBL/min.(100)
				β_p max	128,53	
				β_p mid	114,03	
3	Strength of the pressure after 25 cycles of freezing and thawing	B.B8.012	MRa	β_p min	98,33	BBL/ Permitted loss of strength on the pressure after M ₂₅ cycles-max 20%
				β_p max	116,53	
	Loss of strength		%	ZM ₂₅	12,43	
4	Water absorption	B.B8.010	% /m/m/	U	0,4	CONC/max(1.0) AC/max(0.75;1.0) TAMP/max.(1.0)
5	Abrasion resistance with scraping	B.B8.015	Cm ³ /50 cm ²	Ab	22,75	CONC/max.(35.0) AC/max.(12.0; 18.0 ; 35.0)
6	Volume with the pores and cavities	B.B8.032	kg/m ³	γ_v	2630	(2000-3000)
7	Volume without the pores and cavities	B.B8.032	kg/m ³	γ_s	2690	(2000-3000)
8	Coefficient of the volume	B.B8.032	Coef.	i	0,978	/
9	Level of density	B.B8.032	%	SG	97,8	/
10	Porosity	B.B8.032	% /m/m/	p	2,2	Max.(5.0)
11	Consistency on the effect of ice	B.B8.002	% /m/m/	ZMr	0.6	Max.(5.0)
12	Mineralogical-petrographic composition	B.B8.003	% /m/m/	MPS	Suitable	Suitable

Abbreviated markings denote: CONC-concrete
AC- asphalt concrete
BBL-Bituminous base layer
TAMP-tampon

II/ CHEMICAL ANALYSIS OF A STONE (partial) – MKS B.B8.042:

-Sulphates – does not contain
-Sulphides – does not contain

Chlorides – does not contain
Total sulphur – does not contain

III/ MINERALOGICAL-PETROGRAPHIC COMPOSITION OF A STONE – MKS B.B8.003

The testing was made according to standard MK.B8.003 because of what is made petrographic preparation, which is macroscopically and microscopically analyzed. To other sample was made only macroscopic analysis. Mineralogical-petrographic analysis is made with optical microscope in missed light, brand Leitz – vetzlar , Germany and when analyzing the material is used diluted HCl – acid.

Macroscopic description:

The sample is characterized by bright pink color. It has finely and fine grained composition and solid, massive and slightly hollow texture. At the base are seen small irregular shapes with size of about 2mm that are colored gray. There are noticed irregular rounded shapes of the table, giving it a nice colorful look of travertine. With cold diluted HCl-acid reacts violently, suggesting calcite composition.

Microscopic description:

With the microscopic examination is seen that it is calcium carbonate rock, which is consisted of basic mineral calcite. Calcite mass appears in crypto crystalline and micro crystalline form. They are re-crystallized irregular fine-granular grains of calcite or are in the process of re-crystallization. They often appear as irregular, rounded and lengthened shapes with crypto crystalline calcite, around which appears crystallized calcite. Some of these forms inside are filled with micro crystalline calcite. In some of the forms the calcite is re-crystallized in lengthened crystals perpendicular to the edges of the forms. The size of re crystallized calcite crystals ranges from 10-100 microns. Rarely are represented cavities that are empty and with dimensions up to 0.5 mm. Secondary minerals are quartz, mineral and muskovite that appear rarely in grain form. The muskovite appears in quite rare and thin individual leaves. Balanced size of the calcite composition and partially irregular rounded shapes of macroscopic travertine give colorful look ,because of which the beautiful exterior decorative stone can be used for arranging surfaces like architectural decorative stone.

Structure: It has a finely and fine grained structure and microscopic crypto crystalline to microcrystalline structure with the size of re-crystallized calcite grains from 10 100mikroni.

Texture: Solid, compact, massive and slightly expressed hollow texture.

Petrographic determination: Travertine

➤ **ANALYSIS OF THE RESULTS WITH AN OPINION FOR THE STONE USABILITY**

According to the performed mineralogical-petrographic analysis of the sample of the locality GJUROVO, municipality Prilep, can be said that it is favorable stone and can find wide application in architectural - construction purposes. The examined sample stone is determined as travertine with

finely and fine grained , crypto crystalline to microcrystalline structure, solid, compact, massive and slightly expressed hollow texture.

According to the determined physic-mechanical characteristics it can be said that the tested stone it is distinguished with the favorable physical and mechanical characteristics for its use as raw material for construction purposes. It is characterized by good, relatively high strength under pressure, which at the examined samples in dry condition expressed as middle value is $\beta_{p \text{ mid}} = 121,80 \text{ MRa}$, in water saturated condition expressed as middle value is $\beta_{p \text{ mid}} = 114,03 \text{ MRa}$, and after 25 cycles of freezing and thawing the middle value is $\beta_{p \text{ mid}} = 106,66 \text{ MRa}$ with percentage expressed reduction of the strength of the pressure $Z \beta_{p \text{ M}_{25 \text{ cycles}}} + 12,43\%$.

The volume of the tested sample is $V_v=2,63 \text{ t/m}^3$,with specific mass $V_s=2,69 \text{ t/m}^3$, level of density $SG=97,8\%$ and porosity $p=2,2\%$. It has relatively small acceptable water absorption $U=0,4\%$ and good resistance of abrasion with scraping $Ab=22,75 \text{ cm}^3/50\text{cm}^3$. This stone shows good resistance on the effect of ice and has loss in mass of which expressed in percentages after 5 performed cycles is $ZMr=0,6\%$.

Because of the good physic-mechanical characteristics and the distinctive decorative nice look of the stone from locality GJUROVO, municipality PRILEP, its primary purpose should be its use as raw material for the production of tiles and tiling arrangement of horizontal and vertical external and internal surfaces, if the massiveness of this rock allows it. For external paving of walkways, squares, walking bridges and other walking trails, as well as for paving sealant, quay and supportive walls is recommended to choose a less hollow parties. For internal arrangement of horizontal and vertical surfaces of individual objects, as well as public building are equally usable the less and the more hollow parties.

according to the established favorable mineralogical-petrographic and physico-mechanical characteristics of the tested rock ,that meets the criteria required for a rock as a material that can produce aggregate for concrete and asphalt mixtures for production of buffer material, material for production of block paving tiles as well as other construction purposes with a note that permanent features that distinguish this rock should be considered, and that is a little bit bigger porosity and greater absorptiveness.

The exhibited results refer exclusively to the examined sample

Do not accept any liability in respect of the authenticity of submitted samples unless sampling is performed by a professional of the Institute of Construction "Macedonia" AD Skopje.

The report must not be reproduced except as a whole. For partial copy is necessary written approval by an authorized representative of the Institute of Construction "Macedonia" AD Skopje.

The report is consisted of a total of 8 pages , including the cover.

DIRECTOR OF THE LABORATORY

Illegible signature and a seal from the

Institute of Construction "Macedonia" AD Skopje

Gjorgi Goshev, graduated Engineer of Construction

Report number: AKK – 06/2013-353