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POSSIBILITY OF STONE USE FROM THE QUARRY "BRESJE" IN JAGODINA AS A TECHNICAL CONSTRUCTION STONE**

Abstract

In the period May-June 2017, the Laboratory for Geomechanics of the Mining and Metallurgy Institute Bor, performed the laboratory tests of natural stone from the quarry "Bresje" near Jagodina, as a technical construction stone. Tests were carried out to the extent prescribed by the domestic regulations in order to obtain an exploitation permit. The results of physical-mechanical, petrographic and chemical characteristics that allow or limit its use as a technical building stone are presented in this paper.

Keywords: *quarry, Bresje, technical construction stone*

INTRODUCTION

Test samples for physical and mechanical laboratory tests, i.e. partial and complete analysis of the stone, were carried out on selected samples from boreholes and stone

monoliths (taken from the main level and the core of boreholes - Fig. 1) in the Laboratory for Geomechanics. Ten partial and one complete analysis were performed.



Figure 1 *The appearance of the main level and taken samples for tests*

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**RESULTS AND ANALYSIS OF
PHYSICAL - MECHANICAL,
MINERAL - PETROGRAPHIC AND
CHEMICAL TESTS**

Laboratory test results of stone samples were summarized for the partial and complete analysis in Table 1.

Table 1

No.	Technical properties of stone from the quarry "Bresje" near Jagodina	Value (medium)/ parameters	
1.	MINERAL-PETROGRAPHIC COMPOSITION SRPS B.B8.003	Gneiss	
2.	UNIAXIAL COMPRESSIVE STRENGTH SRPS B.B8.012	- in dry condition	129.76 [MPa]
		- saturated with water	117.51 [MPa]
		- after frost effect	138.50 [MPa]
3.	WATER ABSORPTION SRPS B.B8.010	0.319 [%]	
4.	FREEZING TEST FOR NATURAL STONE SRPS B.B8.001 (loss of mass [%])	steady	
5.	DENSITY SRPS B.B8.032	2.648 [g/cm ³]	
6.	BULK DENSITY SRPS B.B8.032	2.701 [g/cm ³]	
7.	POROUS SRPS B.B8.032	1.70 [%]	
8.	BULK DENSITY COEFFICIENT SRPS B.B8.032	0.983	
9.	VELOCITY OF LONGITUDINAL WAVES SRPS EN 14579 (en)	4407 [m/s]	
10.	TESTING OF NATURAL ROCK BY THE MACHINE "LOS ANGELES" SRPS B.B8.045	22.50 [%]	
11.	GRINDING RESISTANCE – BEME SRPS B.B8.015	10.328 [cm ³ /50 cm ²]	
12.	CONTENTS (SRPS B.B8.042):	Cl ⁻ <10 - 18 [ppm]	

ANALYSIS OF TEST RESULTS

Detailed laboratory tests of natural stone have determined the following:

a) Mineralogical-petrographic analysis

According to the genesis, the natural stone from the "Bresje" quarry near Jagodina is a metamorphic rock - gneiss, slate texture and granoblastic with elements of

the lepidoblastic structure. Quartz, feldspar and biotite are observed macroscopically on a fresh fracture (intersection) that is a light gray. As a sign of surface effects,

reddish (limonized parts of the sample - Figure 2) were observed. The wall is made of quartz, feldspar, biotite and muscovite.

The secondary minerals are epidote, coisite and magnetite, and secondary minerals chlorite, sericite and lemonite.



Figure 2 Fresh cross section of sample (binocular magnification 20X)

b) Physical properties

These parameters are defined over bulk density with and without pore and cavities, porosity and water absorption. Density ranges from 2.622-2.686 g/cm³, bulk density ranges from 2.648-2.826 g/cm³. Porosity from the complete analysis is 1.70%, which puts it in a stone of low porosity. Water absorption is in the range of 0.180-0.586 %, which meets the quality requirements of technical stone according to SRPS B.B2.009: 1986 standard.

c) Mechanical properties

Parameters are defined by the uniaxial compressive strength in a dry and water-saturated state and after the effects of frost (for complete analysis), as well as through abrasion resistance.

Pressure in a dry state ranges from 111.71-181.97 MPa; in a saturated state it goes within the limits of 80.54-171.81 MPa, and after the action of frost, the pressure value of 138.50 MPa is obtained

(complete analysis), which meets the quality requirements of technical stone according to SRPS B.B2.009: 1986 standard.

During the partial stone analysis, a significant deviation of pressure strength values of two samples was observed, which is the only characteristic that does not follow the other good properties of the stone in full measure. Nevertheless, the average uniaxial compressive strength is over 120 MPa (in dry state) and can be estimated to be medium high.

The results of abrasion resistance testing results range from 8.315-15.520 cm³/50cm². According to the abrasion resistance value (35 cm³/50cm²), the samples meet the requirements according to SRPS B.B2.009: 1986 standard.

From the complete stone analysis, it can be seen that the result of testing stone on resistance by Los Angeles machine is 22.50 %, which is within the allowed limits according to SRPS B.B2.009: 1986 standard.

Based on the obtained value of the Bond working index $W_i = 11.28$ kWh/t, the conclusion is that it is a medium-sized raw material, or a raw material in which no high grinding resistance is expressed.

a) Chemical characteristics

Based on the chemical analysis of the stone, it was found that the level of total sulfur and chloride, which could negatively influence the concrete preparation, far below the maximum allowed value.

CONCLUSION

According to the established results of the investigation, it can be concluded that the natural stone from the "Bresje" quarry near Jagodina has good physical and mechanical properties.

From the standpoint of technical petrography, the tested natural stone is suitable for use in construction as a technical stone that can be used as a constructive material in the raw or processed state. The properties that limit the use of this stone are the result of mineral composition, structure and texture of tested natural stone (hardness about 7 by Moss), which is not suitable for the production of aggregates for making layers of pavement structures.

On the basis of a comprehensive analysis of the results of laboratory tests and in accordance with the technical condi-

tions from the applicable standards, the natural stone from the quarry "Bresje" near Jagodina can be used as a technical construction stone, that is, as a hydraulic construction stone - broken, semi-finished and processed, the watercourses and all types of hydrotechnical facilities.

In the course of further use of this quarry, it is necessary to carry out more detailed laboratory tests, especially in deeper parts of the deposit, due to the observed decrease in mechanical properties of the stone, which can be a limiting factor for further use.

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