

QUALITY INVESTIGATION OF SAND FOR THE PRODUCTION OF AGGREGATES ON VINOGRADI LOCALITY (DELIBLATSKA PEŠČARA)

Sladana Krstić¹, Emina Požega¹, Sanja Petrović¹, Srdana Magdalinović¹, Daniela Urošević¹, Slavica Miletić¹, Zdenka Stojanović Šimšić¹

¹Mining and Metallurgy Institute Bor, Zeleni bulevar 35, 19210 Bor, Serbia

Abstract

This paper represents a study which was made to evaluate and interpret the variations in the quality of sand as potential raw materials for the production of aggregate on Vinogradi locality (Deliblatska peščara). Since deposits of sand constitute a valuable resource for a region it is desirable that extent and quality variations of these deposits are known. It was hoped that an evaluation of certain properties of the sands would assist in determining the value of the Vinogradi locality (Deliblatska peščara) as an undeveloped aggregate source by indicating the relative quality of the sand from alternate sites of the Deliblatska peščara.

Keywords: raw material, quality investigation, sand, Deliblatska peščara, the production of aggregates.

1. INTRODUCTION

The largest European continental sandy terrain is located in the south-east part of the Pannonia Plain, i.e. in Banat, covering the area of nearly 35,000 ha. It is of elliptical shape and extends from south-east to north-west. It was formed during the Ice Age from the vast layers of silica-carbon sand. In the Modern Age, the east wind called “Košava” formed a clear dune relief, rising between 70 and 200 meters above sea level^[1,2,3]. Locality Vinogradi it is spatially located on the territory of the municipality of Alibunar^[4] (Figure 1). Samples submitted for partial tests, in addition to the existing field markings that contain the place (locality) of geological research, the mark of the exploration work and the testing interval, also received laboratory markings of analyzes. The weight of the individual samples was about 20 kg. Table 1 shows the laboratory markings of composite tests and the method of their formation (four individual tests in the manner required by the customer).

Table 1. General data on individual samples on location Vinogradi

Serial number	Well mark	Field rehearsal mark	Trial interval (m)	Composite (m)
1.	K-1/19	P-1/19	2,00-7,00	20,00
		P-3/19	1,00-6,00	
		P-5/19	2,00-7,00	
		P-7/19	3,00-8,00	
2.	K-2/19	P-2/19	7,00-12,00	20,00
		P-4/19	6,00-12,00	
		P-6/19	7,00-12,00	
		P-8/19	8,00-13,00	

2. EXPERIMENTAL

Examination of the quality of natural aggregate (sand) of Vinogradi locality, Banatski Karlovac was performed in accordance with Article 202 of the Rulebook on classification and categorization of reserves of solid mineral raw materials and keeping records on them (Official Gazette of SFRJ, No. 53/79), ie in accordance with the standards prescribing the quality of mineral raw materials for a given application:



Figure 1. Sand on the locality Vinogradi (the territory of the municipality of Alibunar);
by [https:// geografijazasve](https://geografijazasve), 04.04.2020

- SRPS B.B2.009: 1982 (withdrawn) - Natural aggregate and stone for the production of concrete aggregates. Technical conditions,
- SRPS B.B2.009: 1982 (withdrawn) - Natural aggregate and stone for the production of concrete aggregates. Technical conditions, SRPS B.B3.100: 1982 (withdrawn) - Fractionated stone aggregate for concrete and asphalt. Technical conditions,
- SRPS B.B2.010: 1986 (withdrawn) - Fractionated stone aggregate (granulate) for concrete. Technical conditions, and
- Rule book on technical requirements for fractional aggregate for concrete and asphalt ("Official Gazette of RS", No. 78/2020).

3. RESULTS AND DISCUSSION

The methods used in the scope of testing partial and complete sample analyzes are presented by the following standards.

Individual samples were tested by the methods: granulometric composition, content of fine particles, content of clay lumps, water absorption, bulk density in loose and compacted state and bulk density (Table 2).

Table 2. Test results of individual samples

	Bulk density in loose state	Bulk density in compacted state	Bulk density (pycnometric method)	Water absorption < 4 mm [%]
standard deviation	48,85	62,25	41,06	1,80
coefficient of variation	0,05	0,05	0,01	0,34
coefficient of variation [%]	5,47	4,98	1,46	33,60
Minimum	824	1192	2780	3,39
Maximum	988	1390	2880	7,86
Range	164	198	100	2
Mean	894	1251	2815	5,35
Median	884	1237	2800	4,87
Variance	2385,93	3875,27	1685,71	3,23

The complete sample analyzes test results of are shown in the Table 3, Figure 2 and Figure 3.

Table 3. Methods used in the scope of testing of complete sample analyzes and presents of the results

Ordinal no.	Characteristic		Test method	Results (Mean)	Technical requirements
1.	Mineralogical-petrographic composition		Annex III-Z	Fine grains quartz sand	1)
2.	Ingredients that prevent hydration of cement		Annex III-Z	not contain	Must not contain
3.	Bulk density γ_p [kg/m ³] (pycnometric method)		SRPS ISO 7033	2815	2000-3000 kg/m ³
4.	Water absorption		SRPS ISO 7033	5,35	Max 1.5%
5.	Resistance to frost		Annex III-O	2.5	Loss max 12%
6.	Total sulfur as SO ₃		Annex III-NJ	0.002	Max 1.0%
7.	Chloride content		Annex III-NJ	≤0.001	Max 0.10% Max 0.02% ²⁾
8.	Content of organic matter		Annex III-M	Color lighter than standard	Color lighter than standard
9.	Grain shape		Annex III-S	0	Min 0.18
10.	Granulometric composition, passage through a sieve, %	2.00 mm	Annex III-I	100	1)
		1.00 mm		99.9	
		0.5 mm		99.7	
		0.25 mm		99.3	
		0.125 mm		92.9	
11.	Content of fine particles [%]	0,09 mm	Annex III-K	44.4	1)
		0.063 mm		14.2	
12.	Content of clay lumps [%]		Annex III-E	0	1)
13.	Grain moduls			0,20	1)
14.	Content of crumbly grains [%]		Annex III-LJ	0	1)
15.	Content of light particles[%]		Annex III-J	14.17	1)
16.	Grain surface coverage[%]		Annex III-Z	0	1)
17.	Resistance to crushing and wear [%]		Annex III-P	5.0	Max 35%
18	Bulk density in loose and compacted state[kg / m ³]		SRPS ISO 6782	893	1)
				1251	
1) Technical requirements are not determined, but the test results are stated in the Test Report					
2) If the aggregate is used for the production of prestressed concrete					



Figure 3. Microscopic appearance of fraction 0.250 / 0.125 mm, binocular magnification 40X

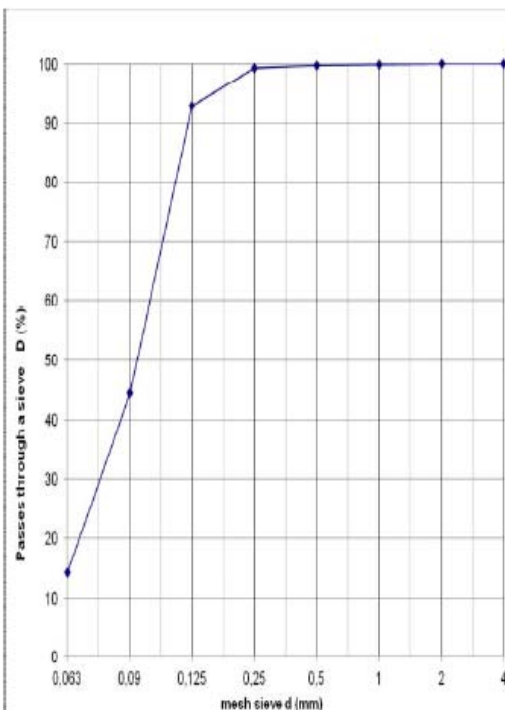


Figure 4. Granulometric composition of raw material

The analysis of the results of raw material quality testing was performed on the basis of the above the results of the examination and in accordance with the requirements quality for stone aggregate of Rule book on technical requirements for fractional aggregate for concrete and asphalt ("Official Gazette of RS", No. 78/2020).

In accordance with the requirements quality for stone aggregate of Rule book on technical requirements for fractional aggregate for concrete and asphalt ("Official Gazette of RS", No. 78/2020) raw material not satisfying, but,

Fine-grained quartz sand from the locality "Vinogradi", can be used for the production of lower bearing mechanically stabilized (tampon) layers of pavement structures according to the technical specification of ЈП ПУТЕВИ СРБИЈЕ from 29.12.2009. for the lower base layer:

- A layer of unbound stone material - sand.

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