APPRAISAL OF USABILITY THE DISINTEGRATED GRAVELLY SANDSTONE (TO THE GRADE OF NATURAL MIXTURE OF SAND AND GRAVEL)

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Abstract

Aggregates are important constituents of pavement structures. The performance of aggregate layers depends on particle shape, grading and composition and their physical, mechanical and chemical properties. Careful study of these properties allows evaluation of aggregates according to the international norms. There are the huge aggregate reserves around Negotin, Serbia. With a growth of construction in and around Negotin, the demand for aggregates has become so high that the limited quarry sites within the valley are not sufficient to meet the demands. Therefore, by searching for rock outcrops from which the suitable aggregates can be extracted, it is sought to meet the current and future needs of aggregates suitable not only for building and infrastructure, but also for roads or transport networks in the country. This study aims to research and evaluate the suitability of natural disintegrated, that is, crushed rock aggregates in the area Paunovac near Negotin, Serbia the unbound parts of the pavement structure. Disintegrated siltstones and calcareous siltstones were mainly identified in the research area.

***Keywords**: natural disintegrated rock, crushed rock aggregates, road infrastructure, area Paunovac near Negotin in Serba*

1 INTRODUCTION

Laboratory tests of mineral raw materials (disintegrated pebbly sandstone to a degree of natural mixture of sand and gravel) in the researched area Paunovac near Negotin, Serbia, were carried out for the purpose of realizing the scope and methods in order to assess the quality of use the same in construction.

In accordance with Article 202 of the Rulebook on classification and categorization of reserves of solid mineral raw materials and record keeping [1-4], the Mining and Metallurgy Institute Bor has implemented the Project of applied geological research of sand in the research area Paunovac, near Negotin in Serbia.

Scope of investigation was a partial and complete analysis. Type of study: Determination of the moisture content, Determination of the granulometric composition, Determination of the content of small particles, Determination of the content of clay lumps, Approximate determination of pollution by the organic substances, Determination the bulk density in the loose state, Determination of the bulk density in a compacted state, kg/m^3, Determination of the content of organic matter, Determination of the ratio of humidity and dry volume of the soil (Proctor's test), Determination of the California carrying capacity index (CRB), and Determination of the general soil classification.

2 EXPERIMENTAL PARTIAL AND COMPLETE ANALYSIS

The researched area Paunovac near Negotin is located on a part of the geological map 1:100 000 L34-132. According to the research works [5], the quantities of individual samples are taken, as a way of forming the composite samples. The results are given in Tables 1 and 2.

Table 1 *Individual sample of the tests*

Sample	Research pane	Trial interval (m)	Laboratory		Rehearsal	Weight (kg)
			Number of sample	Code of sample test		
U1.	O-1	0,30-5,00	2306/22	NMSG2306	1	30.0
U2.		5.00-8.00	2307/22	NMSG2307	2	30.0
U3.	O-2	0.20-5.00	2308/22	NMSG2308	3	30.0
U4.	O-3	0.30-5.00	2309/22	NMSG2309	4	50.0
U5.	O-4	0.40-5.00	2310/22	NMSG2310	5	30.0
U6.	O-5	0.40-5.00	2311/22	NMSG2311	6	30.0
U7.	O-6	0.20-5.00	2312/22	NMSG2312	7	30.0
					In total:	230.0

Table 2 *Composite sample of the tests*

N^o	Sample N^o	Laboratory number of sample	Laboratory code of sample	Sample formed by the lab. sample N^o	Test weight (kg)
K1	U8.	2313/22	NMSG2313/22	2306/22	30.0
				2307/22	30.0
				2308/22	30.0
				2309/22	50.0
				In total:	140.0
K2	U9.	2314/22	NMSG2314/22	2310/22	30.0
				2311/22	30.0
				2312/22	30.0
				In total:	90.0

3 RESULTS AND DISCUSSION

The results of studied properties of the raw material [5] in the research area are:

- Moisture content 5.9 %;
- Water absorption value 6.9 %;
- Granulometric composition i.e., Petrogenic Composition [1-4] according to the grain size (Figure 1 and Figure 2): Clay+Dust 0.063-0.0 mm 0.8 %; Sand 0.063-2 mm 53.7%; Gravel 63-2 mm 41.9 %; Crush 125-63 mm 3.8 %; D_{50} Grain size at 50 % content is 2.3 mm,
- Content of small particles (< 0.09 mm 12.5 %); (< 0.063 mm 11.5 %); (< 0.002 mm 5.8 %;);
- Content of clay lumps 0.0 %;
- Content of pollution by the organic substances 1.17 %;

- Content of volumetric mass in a loose state 1440 kg/m^3;
- Content of volumetric mass in a loose state 1684 kg/m^3;
- Ratio of soil moisture to a dry volume (Proctor's test) $\gamma_{d\,max}$ 1.94 t/m^3; and $w_{opt.}$ 11.98%;
- California bearing index (CRB 61.16 %);
- General soil classifications (Parameters of Laboratory Soil Classification: D_{10} 0.3 mm; D_{30} 1.1 mm; D_{60} 3.6 mm; Uniformity Coefficient Cu 10.5; The Curvature Coefficient Cz 1.5): Well Graded Gravel Cu>4; 1<Cz<3;
- Mineralogical-petrographic composition: Pebble sandstone with calcite binder (disintegrated pebbly sandstone to a degree a natural mixture of sand and gravel 0/125 mm). Shape factor (F) ranges from 0.99 to 1.40 in most of the samples indicating their cubic to disc shape. Aggregates have the high roughness indices and moderate roundness indices.

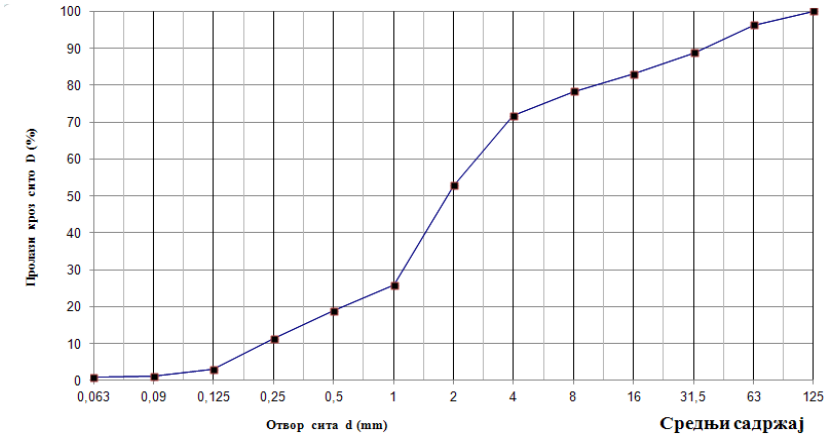

Figure 1 *Diagram of granulometric composition, the average content of the test*

Figure 2 *Fragment of pebble sandstone with calcite binder 75/125 mm (left) and sandstone clast-SiO_2 binder in pebble sandstone 32/63 mm (right)*

The results obtained by the Partial and Complete analysis of sample are in agreement.

According to the requirements of the SRPS U.E8.010 standard [6] (Design and Construction of Roads, Bearing Capacity and Flatness at the Bed Level), the material should meet the following characteristics:

- The maximum dry volumetric mass according to Proctor's test must be ≥ 1.6 t/m^3.
- Hazen coefficient of unevenness U must be > 9 for cohesive and > 4 for crushed stone materials.
- California CBR_{lab} bearing index must be > 3 %.
- The content of organic matter must be < 6 %.

The following characteristics of material were obtained through the laboratory testing:

- The maximum dry volumetric mass according to Proctor's test is 1.94 t/m^3.
- Hazen coefficient of unevenness U is 10.5.
- California CBR_{lab} bearing capacity index is 61.16 %.
- The content of organic materials is 1.17 %.

4 CONCLUSION

The tested disintegrated gravelly sandstone to the degree of natural mixture of sand and gravel at the research area Paunovac near Negotin in Serbia can be used as a raw material.

Also, it can be used as the unseparated natural aggregate, i.e. raw material for the production of placentas (according to the requirements of the standard SRPS U.E8.010:1981[6]).

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