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SUBSOIL STABILIZATION WITH LIME

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Abstract

Soil stabilization represents process for improvements physical-mechanical and deformation feature of soil, adding binders. There are two basic kinds of stabilization: mechanical and chemical. Chemical stabilization of soil refers on addition binders to basic material of soil. The most common materials in chemical stabilization soil are lime and cement. In this work will to be shown the results stabilization soil with lime, for access roads on territory of the city of Bor.
Keywords: *stabilization soil, access road, soil, lime, cement*

1. INTRODUCTION

Physical, mechanical and deformation characteristics of subsoil, on place of future construction of the object, are very important factor. If the subsoil does not satisfy conditions prescribed in Project of construction, it should be replaced or stabilized. Most often, soil stabilization is performed by using two kinds of binders: lime and cement. Which one will be used depends from a lot of factors, such as mineralogical composition of subsoil, grain size distribution curve, organic matter content etc. After completed selection of binders, its implementation is achieved.

To make everything realized, it was, previously, necessary to carry out laboratory tests of subsoil, for determination of all necessary factors.

It is also necessary to perform laboratory examines to see how the stabilized ground will behave, and will it fulfill the requirements of the Project.

In this paper will be shown the results of laboratory examinations of subsoil, to whom, as a binder material, is added a lime in different rates, 5% and 8%.

2. PHYSICAL MECHANICAL AND DEFORMATION PROPERTIES OF SUBSOIL MATERIALS

In the area of Bor city, access roads should be built, in order to connect certain areas with the main roads.

That is why it was necessary to carry out a geomechanical test of the subsoil material, in order to see if it meets the requirements of the project for the construction of such roads.

According to the terms of the Project, the material should have the following properties:
- Classification per AASHTO A6 and better ,
- Maximum laboratory compactness for E = 600 kNm /m ^{3} larger than 1600 kg/m^3,
- Optimal humidity w_{opt} = 14-16%.

Classification per AASHTO, Class A6, implies dusty-clay material with the next one granulometric and consistency characteristic:

- More of 35% of the material passes through Sieve opening 0.075mm,
- That the liquid limit is max 40%,
- The index plasticity is min 11%

2.1. Subsoil properties

Subsoil properties, which are laboratory examined, are shown in Table 1.

Table 1. *Grain size distribution and consistency limits of subsoil*

Granulometric composition						Plasticity			
Cobbles	Gravel	Sand	Silt	Clay	Passing through a sieve 0,075mm	Limits		Plasticity index	Soil classification
>60	60-2.0	2.0-0.063	0.063-0.002	<0.002		W_L (%)	W_p (%)	I_p (%)	
(%)					(%)				
-	28,82	54,62	16,56	-	18,00	30,65	19,02	11,63	CL

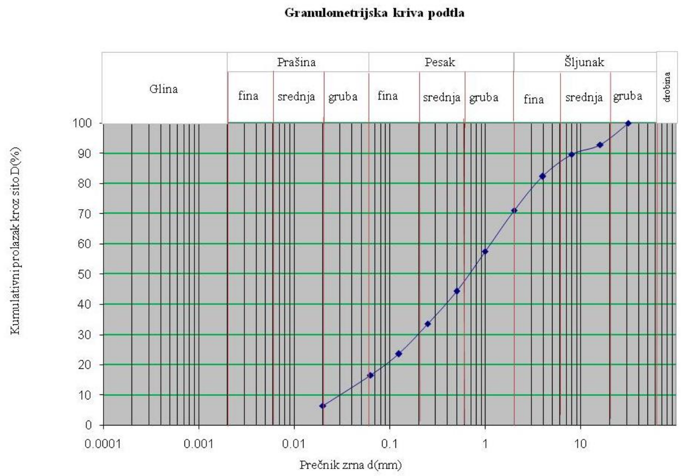

Figure 1. *Graphic representation of the grain size distribution of the subsoil material*

In addition to those shown properties, subsoil material was tested by the Proctor test, the CBR test and the determination of the compressive strength of the soil after the Proctor test.

Tests have shown the following:

- Maximum dry density from Proctor test, at a compaction energy of E = 600 kNm/m ^{3}, is 1732 kg/m ^{3},
- Optimal humidity w $_{opt}$ = 12.53%,
- CBR = 11.68%,
- Uniaxial compressive strength of the material from Proctor test σ_p = 0.275 MPa

After the basic tests of the subsoil were completed, it was homogenized with lime in different proportions: 5% and 8%, Figure 2.

Figure 2. *Homogenization material of subsoil with 5% lime*

The homogenized material was then compacted in the Proctor apparatus under the same conditions as the base soil, with an optimal moisture content of 12.53% and a compaction energy of E = 600 kNm/m^3. Three test bodies were created from the compacted material in order to be tested after 7, 14 and 28 days of ripening, Figure 3.

Figure 3. *Appearance of the prepared test bodies*

The results of testing the compressive strength of the homogenized material are shown tabularly (table 2) and graphically, figure 4.

Table 2. *Presentation of compressive strengths of homogenized materials with 5% and 8% lime*

Time maturation mixtures, (day)	UCS of material with 5% lime, (MPa)	UCS of material with 8% lime, (MPa)
7	0.396	0.587
14	0.491	0.778
28	0.572	0.927

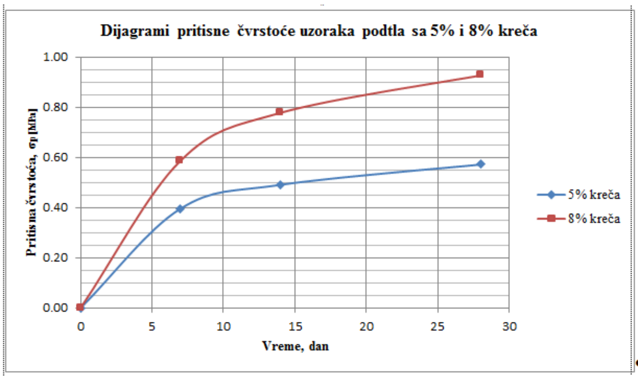

Figure 4. *Graphically display UCS of homogenized material, after 7, 14 and 28 days*

Comparing the value of compressive strength of the base material and given mixtures, it is concluded that there was an increase in compressive strength, especially in the mixture with 8% lime.

3. CONCLUSION

The use of lime as a binder for fine-grained, coherent or partially coherent materials results in an increase in the compressive strength of the soil and a decrease in the plasticity index. This method is one of the more economical methods, considering the availability of cement on the market and its price.

In the paper, it can be seen that the compressive strength of homogenized mixtures, with different lime content, increases with maturation time. As expected, the mixture with a higher lime content achieved, after 28 days, a higher compressive strength ($\sigma_{p\ (8\%\ lime,\ 28\ days)} = 0.927$ MPa) than the mixture containing 5% lime ($\sigma_{p\ (5\%\ lime\ ,\ 28\ days)} = 0.572$ MPa). Which of these mixtures will be applied on the field depends on the characteristics of the stabilized soil required by the Project.

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