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Improving the Construction of the Highway using Rocky Material Disintegrated by Blasting

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Abstract

In construction practice it is often possible to replace the building material, which is planned in the design phase, by the local cheaper material. In this paper analysis of the possibility of replacing the retaining structure of reinforced earth, which is envisioned in the main design of the Highway E-80: Niš – Dimitrovgrad, by embankment of disintegrated rocky material, is presented. This material is obtained by blasting the rock mass near this location. Recommendations for changing of the main design were given based on the results of the computational slope stability analysis which was performed by the limit equilibrium method, according to Spencer's solution. Due to this change the organization of construction works is significantly improved.

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Keywords: urban area, organization of construction works, building materials, disintegrated rocky material, retaining structure, reinforced earth, embankment, slope stability.

1. Introduction

The Corridor X is one of the most important Pan-European road corridors. It runs between Salzburg in Austria and Thessaloniki in Greece. The corridor passes through Austria, Slovenia, Croatia, Serbia, Macedonia and Greece. Serbian section of Corridor X is part of two important Pan-European transport infrastructure networks. One is connecting Budapest with the Bulgarian capital of Sofia, the other linking Greece to the north. The construction of

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Corridor X through Serbia is carried out through 4 projects, one of which is Project East E-80: Nis –Dimitrovgrad (Corridor Xc), total length of 83.4 km. The road route E-80 is immensely important and has an essential traffic function in terms of being the shortest route connecting Western and Central Europe with the Near and Middle East. The project area for motorway on the E-80 alignment belongs to the southern part of Eastern Serbia. The highway stretches in the direction northwest to southeast, from the city of Nis through Bela Palanka to Pirot to Dimitrovgrad.

The motorway route cross very difficult terrain and include 12 tunnels and there are long and steep downhill gradients. A complex geological structure, various and highly active tectonic movement, including later erosion caused by numerous factors, have contributed to the morphological variety of the project area [1-26].

2. Designed retaining structure of reinforced earth

The main design of the Highway E-80: Niš – Dimitrovgrad, Section 4: Čiflik – Staničenje, envisages the construction of retaining structure of reinforced earth in two levels:

Level 1 - from km 53+085.74 to km 53+336.00, total length of 254 m.

Level 2 - from km 53+183.39 to km 53+301.50, total length of 120 m.

The layout plan of this part of the route, with marked position of the retaining structure of reinforced earth is shown in Fig. 1.

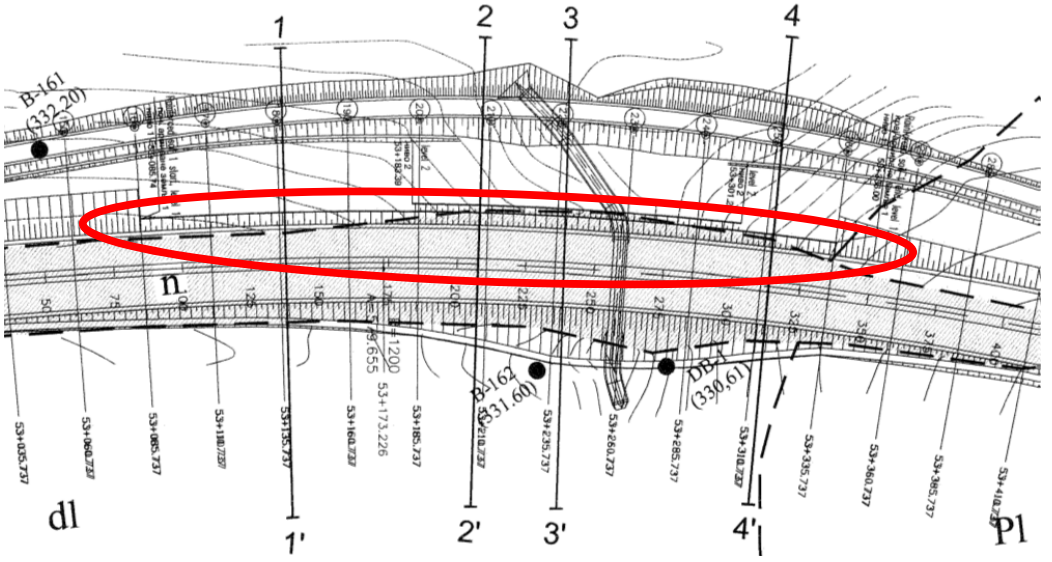

Fig.1.The position of the retaining structure of reinforced earth in the layout plan of the route

The designed retaining structure is a composition of stone or earthen fill (embankment), geogrid and concrete blocks used for facing of the front face of the wall. Geogrid accepts tensile forces from the soil, while concrete blocks are used for the formation of the designed geometry of the wall face. The front face of the structure is vertical, in order to reduce the engaged area. On the part of the route where the retaining structure of reinforced earth has two levels, the transition between the levels is realized by grass berm having width of 2.50 m.

The main design is stated that the road embankment and retaining structure of reinforced earth should be built from material excavated along the route. Soil layers embedded in the retaining structure of reinforced earth should be compacted so that the modulus of compressibility Ms is not less than 35 MPa.

Computational analysis of the stability of the retaining structure of reinforced earth is performed on specific profiles, from Profile No. 16 (at km 53+085.74) to Profile No. 26 (at km 53+335.74). Analysis of the internal stability, analysis of global stability, and analysis of soil bearing capacity was performed. All necessary calculations were performed using the software package SLOPE/W, the limit equilibrium method, according to Spencer's

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