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Assessing the Relationship of Mineability of Rocks and Machines for Earthwork

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Abstract

Classification of the mineability of rocks is an integral part of the earthworks occurring in the implementation of engineering works. The existence of degrees of excavation difficulty allows us to specify the needs of mechanisms for earthworks. It is determined according to the old standard CSN 73 3050, and new standard CSN 73 6133. Both standards define the mechanical mechanisms that should be used for each degrees of excavation difficulty. Based on this rock may be the most optimal breakage and extracted without machine selection would have been undersized. That would mean its destruction and inefficient extraction of rocks, or contrary oversizing. On that basis, there would be an unreasonable overpricing earthworks. Into force has already entered a new standard but there are a number of differences in their classification. The publication deals with the evaluation degrees of excavation difficulty, and mechanical mechanisms for earthwork and differences between the two standards, respectively their similarities. It is evident that the old standard represents a very detailed division of soil and rock into seven degrees of excavation difficulty and thus represents a substantially transparent calculation of the total price of earthworks. In contrast, the new standard gives only three degrees of excavation difficulty. This represents a major simplification of the process of classification and subsequent utilization of engineering mechanisms.

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1. Introduction

Classification mineability of rocks is an important part in the implementation of earthworks. Mineability of rocks is determined by the geotechnical characteristics of the rock environment. We distinguish cohesive soils, non-cohesive soil and rock and weak rock. The parameters of the individual types of rocks are reflected in the possibilities of their

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mineability of rocks. In selecting the method of mineability of rocks is also reflected economic aspects of construction work, demands on space, noise, and a number of other restrictions related to the implementation of the project. Aspects of transport equipment are listed authors [2] [1] [17] and [9]. An important role is also played efficient logistics [11] and as already mentioned study costs in connection with the use of heavy mechanics [15] [3] [10].

Determining the mineability of rocks is governed by the CSN 73 3050 Earthworks, which specifies individual degrees of excavation difficulty. It is divided into classes 1 to 7. We classify and sort the different types of soils on the basis of these classes. Cohesive soils are classified based on soil consistency and plasticity. Non-cohesive soils are classified based on compactness and the quantity of stones and boulders. Rock and weak rocks are classified according to compressive strength and by fracturing. Characteristics of earthworks is also listed in the publication [6]. Use of heavy mechanics in relation to the type of rock is studied in works [20] [18] [19].

On the basis of that ***standard CSN 73 3050***, we divide the rocks on the pour, dig 1, dig 2, crumbly solid, easy for blasting explosives, difficult for blasting explosives, and very difficult for blasting explosives. For each of the classes are defined the machine through which the rock should be mined. On the basis of this knowledge, it can be roughly determining the calculation of these works before the commencement of this activity. On the basis of this classification, the *first group* can be mined using a shovel or large spoon loaders. This class is called *pour rock*. Rocks *second group* are referred to as *dig 1*. These can be extracted using a spade or a shovel loader. The rocks of the *third group* are referred to as *dig 2*. These can be mined with a pickaxe and digging or excavator. The *fourth group* includes rock called *crumbly solid*. These are mined with a wedge or excavator. The *fifth group* includes rocks *easy for blasting explosives*, which can be mined with a ripper and heavy excavators. The *sixth group* of rocks known as rock *difficult for blasting explosives*, which can be mined with a heavy ripper and explosives. The *seventh group* includes *very difficult for blasting explosives* rocks that can be mined only with explosives [4]. On the basis of appropriately selected degree so we can appropriately optimize the use of heavy equipment, it also lists publications [16] [13] [7] [21] and [14]. An inseparable part of the security risks associated with the use of machines [8].

2. Machinery mechanisms in relation to degrees of excavation difficulty

2.1. Loaders

The first degree of excavation difficulty can be mined with a *shovel*. This class includes mainly soil, silty sand and sandy silty or loose gravel. Mining is primarily implemented with a spoon loader. *The second excavation* class includes mainly silty sand and sandy silty, medium dense gravel or silty. In this degree is used *spade and shovel loaders.*
Loaders (Fig. 1) are used only in case of first and second degrees of excavation difficulty. This is a mobile machine whose main component is a shovel. Soil is picking up and cargo on other means of transport with a shovel or may be transported using a loader. This applies only to short distances. Loader performs the function both directly disengagement but can also serve to loading already disengaged soil. There are several types of loaders. It is a spoon loader end shovel loader, rotary shovel loader, shovel loader loading over his head, and special clamshell-loader.

Fig. 1 Wheel loaders.