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STUDY OF THE INFLUENCE OF ROCK MASS QUALITY ON THE PRODUCTIVITY OF THE EXCAVATOR-AUTOMOBILE COMPLEX

Major industrial potential of the country is the mining of mineral raw materials, which is provided by the development of mineral deposits. Currently, the industrial needs in solid raw material are satisfied by open-pit mining. Mining is an energy intensive process; it involves a large number of different mining and transport techniques.

The vast majority of quarries of Ukraine aimed at the production of building materials. Crushed stone is one of the most common materials used in various fields of construction.

Much attention is paid to the investigation of the influence of the granulometric composition of blasted rock for further processing with the aim to reduce the total energy consumption for the destruction of minerals in the preparation of their enrichment. However, the dependence between the degree of the array crushing and the economic performance of the subsequent processes of excavation and transportation of overburden rock is not studied enough.The efficiency of the following technological processes depends on the quality of blasting. To estimate the value of the rational costsfor explosive destruction of overburden rock, theinfluence of the degree of array crushing on techno-economic indices of quarry and transport equipment performance should be determined.

There is a number of publications devoted to the influence of explosive preparation of rock mass to the excavation on the technical and economic indicators of thefollowing processes: secondary crushing, excavation and loading works, rock mass transportation and laying of rocks to the dump. To shorten the duration of ladling andto increase the ratio of the bucket filling it is necessary to increase the coefficient of loosening, which, in turn, depends largely on the degree of the array crushing.

The degree of the massif crushing has the most significant impact on technical and economic performance of the quarry operation and may be expressed in a quantitative value. Requirements for the size and shape of the rock mass collapse depend on the technology and the equipment that is used.When blasting operations, the problem of outsized fractions remains. In this case, the maximum allowable sized piece of blasted rock mass is determined by the parameters of mining and transport equipment or the size of the receiving hole of the bunker.

There is no single criterion characterizing the rock mass structure by size. Very often, the composition of rock mass by size is characterized by a relative volume of large outsized pieces sorted for secondary crushing. Moreover, the output of outsized material is recommended to express in different ways. Usually, the percentage of outsized pieces is determinedby the ratio of outsized material to the blasted massif volume.

In quarries, the limiting parameter to determine the maximum size of outsized pieces is a maximum linear dimension of the excavator bucket or transport vehiclewhich is loadedby the rock mass.Using well-known dependencies, you can define the maximum allowable size of a piece of rock:

$$D_{\text{нег}} = 0{,}8 \cdot \sqrt[3]{E}$$
$$D_{\text{нег}} = 0{,}7 \cdot \sqrt[3]{Vmp}$$

where E - capacity of the excavator bucket, m3 , $V_{тр}$ - body volume of the dump truck m3 .

When transporting the rock mass to the surface, the formula to determine the outsized material will look like the following

$$D_{нег}= 0,75 \cdot B_{конв}$$

whereVconf - conveyor belt width, m3.

The rock mass lumpiness in a mine determines the duration of the dump truck loading and, as a consequence, the duration of the run, as well as the coefficient of a rock loosening in the vehicle body, and the rate of its filling. All these factors affect the load capacity of the truck. A number of scientific papers stdied the effect of rock masslumpiness on the duration of excavation cycle, the coefficient value of the excavator bucket and dump truck body performance, the complexity of a bottom cleaning and outsized material removal, as well as on the frequency of breakdowns and excavators downtime.

The average downtime of the truck duringsortingoutsized materialby excavator can be determinedtaking into account the total number of selected outsized material in the mine during the shift.The number of dump trucks, providing the shipment of the rock mass under the excavator should be also considered. The number of dump trucks, in turn, depends on the duration of the dump cycle, and the excavator loading.

The improvement of technical and economic indicators of the quarry operation can be achieved by improving the quality of drilling and blasting operations and a uniform grinding of rocks should also be considered. The main economic effect will be achieved by reducing costs for the crushing of the outsized material and by increasing the productivity of excavation and loading equipment. The direction of future research is the development of parameters of drilling and blasting, capable of providing a uniform crushing of the rock massif and conducting industrial-experimental studies. This allows to estimate the additional costs for drilling and blasting works and to confirm the economic impact, calculated on the basis of theory-based dependencies.