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**FEATURES OF DIAMOND-WIRE SAWS APPLICATION FOR ROCK OVERBURDEN REMOVAL AT MARBLE QUARRY CONSTRUCTION** *Nosov Magnitogorsk State Technical University,*

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*The article discusses the features of construction marble quarries with application diamond wire saws. In order to reduce period of quarry construction suggested to lead the development of rock overburden using diamond wire saws and chain saw cutting machine. As a result of the research it was found that a complex of rock overburden removal with diamond wire saws and chain saw cutting machine at the bench height of the rock overburden 6 m can increase the profitability of the company from 8.9 to 13.5 %, reduce the quarry construction period by 2 months, as compared with the currently used CSCM.*

*Key words: diamond cable car, performance, marble blocks, the quarry construction period.*

One of the main features of facing stone deposit development is the requirement to preserve the monolithic mined blocks and their decorative qualities and achieve regular geometric shape blocks. Application of diamond wire saws satisfies these requirements [1]. The use of diamond wire saws assumes the two-stage technology. The need for two-stage extraction is associated with large size mined blocks (monoliths). In this case the monolith separated from the solid does not fit the desired size and must undergo cutting into blocks of the required dimensions and shape [2]. Currently in the majority of marble quarries diamond wire saws (DWS) have already been implemented but the possibility of this equipment is not used in full, for example DWS is rarely applied in rock overburden removal.

As a rule, in Russia, fractured marble is traditionally extracted with chain saw cutting machine (CSCM), and removal of this layer takes from 40 to 80 % of the time spent on quarry construction.

If traditional approach for quarry construction is applied, the construction of a quarry with production capacity of 10 thousand m3 blocks can take from 3 to 5 years. As a consequence an entrepreneur invests in the pit construction and when he fails to get trade blocs, he just stops further development [3]. This process can be observed in development of Ryskuzhinskoe, Eleninskaya deposits, etc., the construction of which was suspended. In order to reduce the construction time the research team has investigated the possibility of joint mining of rock overburden and a massif of block with one high bench and combined cutting with the DWS and CSCM. The combination of DWS and CSCM can increase the bench height and shorten the rock overburden removal increasing the production efficiency. In this case the application of CSCM on a horizontal cut of the monolith removes the time-consuming implementation of horizontal drilling which is necessary for DWS cutting [4].

Unlike CSCM, the bench height in DWS cutting is not fixed and is determined by the maximum block output. To substantiate the bench height at the joint production of rock overburden and massif of block DWS the authors studied the effect of the bench height in the range of 6 to 12 m on a period of quarry building (Fig. 1). In the calculations it was accepted that the design productivity of a quarry is 45 thousand m3 and a mobile crane is used as loading equipment.



**Fig. 1. Dependence of construction period on the quarry bench height**

As can be seen from the graph (Fig. 1) greater bench height significantly increases the period of quarry construction due to the increase of the rock overburden volume, thus in further calculations the bench height of overburden stripping is taken as 6 m.

The research team carried out the analysis of options for quarry building with combined CSCM (Fig. 2b) and DWS (Fig. 2a) overburden rock removal at Redutovskogo deposit [5].



a



b

**Fig. 2. Construction of a quarry with different stone-cutting equipment used in the removal of overburden rock: a. rock overburden removal with DWS and CSCM; b. Removal of rock overburden BKM**

As a result of the research it was found that if the quarry productivity is 45 m3 of marble, a complex of rock overburden removal with DWS and CSCM at the bench height of the rock overburden 6 m can increase the profitability of the company from 8.9 to 13.5 %, reduce the quarry construction period by 2 months, as compared with the currently used CSCM.

The efficiency of the DWS and CSCM complex is mainly due to an increase in productivity of stone-cutting equipment, and reduced capital expenditures. Along with the reduction of capital costs the use of DWS rock overburden removal allows you to start production earlier.

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