# ANALYSIS OF MAJOR TECHNOLOGICAL PARAMETERS OF QUARRYING OF BLOCKS OF MARBLE BY "DIAMOND" ROPE STONE CUTTERS

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ABSTRACT

An analysis is done of the technological parameters of quarrying of blocks of marble "Pelegrini" TDD 100 rope stone cutters. Parameters of mined blocks, number of stopes and stone cutters are determined for working with different heights of benches for the conditions of the "Mura – 8" quarry.

Marble blocks in our country are quarried by "diamond" rope stone cutters of the "Pelegrini" TDD-100 type. Quarrying of blocks is carried out from benches of 2,5 m height, from several lamellas, located one by another along the longitudinal or cross axes of the quarrying field.

Height of the bench ($H_{ст}$) is determined depending on length of rope ($l_в$) and parameters of quarried marble blocks under the condition that 2/3 of the rope length is located in the section. When vertical longitudinal cuts are done the maximum height of the bench is:

$$H_{ст} \leq \frac{2}{3} l_в - 2l_{бл}, m, \qquad (1)$$

where $l_{бл}$ is the length of quarried block, m

When horizontal cuts are done the maximum length of the rope is:

$$\frac{2}{3} l_в = (2l_{бл} + b_{бл}), m, \qquad (2)$$

or

$$\frac{2}{3} l_в = (2b_{бл} + l_{бл}), m, \qquad (2)$$

where $b_{бл}$ is the width of quarried blocks, m

When vertical cross cuts are done the height of bench is the highest

$$H_{ст} \leq \frac{2}{3} l_в - 2b_{бл}, m, \qquad (3)$$

The lowest value of bench height is determined by formulas (1) and (3) for standard lengths of rope 20 and 25 m and approved parameters of quarried blocks and it is approved as a designed height of the bench. The required length of rope

(table 1) - $l_{в\ необх}$. Is determined for a given height of the benches and different parameters of quarried blocks and a check is done by formula (2).

Table 1.

| $H_{ст}$, m | 2,5 | 2,5 | 2,5 | 5 | 5 | 5 |
|---|---|---|---|---|---|---|
| $b_{бл}$, m | 1,5 | 2 | 2,5 | 1,5 | 2 | 2,5 |
| $l_{бл}$, m | 5,5 | 5,5 | 5,5 | 6 | 6 | 6 |
| $l_{в\ необх}$, m | 18,75 | 19,5 | 20,25 | 20,25 | 21 | 21,75 |
| $l_{в.ст}$, m | 20 | 20 | 20 | 25 | 25 | 25 |
| $l_{от}$, m | 1,24 | 1,08 | 0,98 | 1,034 | 0,866 | 0,766 |
| $n_з$, бр | 2,48 | 2,16 | 2,0 | 2,05 | 1,73 | 1,53 |
| $S_{вн}$, m²/см | 9,099 | 9,09 | 9,09 | 8,33 | 8,33 | 8,33 |
| $S_в$, m²/см | 33,3 | 25 | 20 | 33,3 | 25 | 20 |
| $S_х$, m²/см | 20 | 20 | 20 | 10 | 10 | 10 |
| $S_{об}$, m²/см | 62,4 | 54,1 | 49,09 | 51,63 | 43,33 | 38,33 |
| $S_{об}$, % | 100 | 87,6 | 78,7 | 82,7 | 69,4 | 61,4 |
| $N_{км}$, бр | 2,5 | 2,16 | 1,96 | 2,06 | 1,73 | 1,53 |
| $V_{бл}$, m³ | 20,6 | 27,5 | 34,4 | 45 | 60 | 75 |

The relative area of cuts for quarrying of 1 m³ rock mass is

$$l_{от} = \frac{1}{b_{бл}} + \frac{1}{H_{ст}} + \frac{1}{l_{бл}}, m^2 / m^3 \qquad (4)$$

The following parameters are determined for the conditions of "Mura-8" quarry, when the average shift productivity of rope stone cutters "Pelegrini" TDD-100 is $Q_{см}$=25 m²/cm and duration of shift is $T_{см}$=11 h, for the quarrying of 17,5 m³/cm marble blocks or 50 m³/cm marble mass for shift:

1. Required number of simultaneously mined stopes (blocks) in the quarry

$$n_з = \frac{Q_к . l_o}{k_и . Q_{см}}, броя \qquad (5)$$

where:

$Q_к$ is the shift productivity of rock blocks of the quarry, m³/cm;
$Q_{см}$ – the average shift productivity of stone cutters, m³/cm;
$К_и$ – coefficient of mined stone blocks (recovery).

Results are shown in table 1 for different parameters of mined blocks ($b_{бл}$, $l_{бл}$ and $H_{ст}$).

2. The needed area for vertical cross cuts for a shift is:

$$S_{вн} = \frac{Q_k}{k_и.l_{бл}}, m^2/см \qquad (6)$$

3. The needed area for vertical longitudinal cross cuts for shift is

$$S_в = \frac{Q_k}{k_и.b_{бл}}, m^2/см \qquad (7)$$

4. The needed are for horizontal cuts for shift is:

$$S_x = \frac{Q_k}{k_и.H_{ст}}, m^2/см \qquad (8)$$

5. The total area for cuts for shift is

$$S_{об}=S_{вн}+S_в+S_x, m^2/cm \qquad (9)$$

6. The needed number of cutting machines for the cuts of one shift is:

$$N_k = \frac{S_{об}}{Q_{см}} \qquad (10)$$

Results from the analysis of those parameters are presented in table 1.

In case it is accepted that the cost for driving the cuts is equal, table 1 shows that the most profitable mining of marble blocks will be realized for $H_{ст}$=2,5 m and $l_{бл}$=5,5 m, $b_{бл}$=2,5 m and respectively for $H_{ст}$=5 m for $l_{бл}$=6 m, for $b_{бл}$=2 m and 2,5 m. For that cases the relative area of cuts is the lowest ($l_{от}$, $m^2/m^3$) and two cutting machines are required.

When the height of bench is $H_{ст}$=2,5 m the use of ropes of length of 20 m is recommended, and for $H_{ст}$=5 m – ropes are recommended to be 25 m long.

REFRENCES

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*Opencast mining and blasting technologies, Faculty of Mining Technology*