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JUSTIFICATION OF TECHNOLOGICAL PARAMETERS OF THE WORKING AREA OF THE QUARRY

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Abstract
The working area of the quarry corresponds to that part of it in which the main production processes are carried out, i.e. a set of ledges that are in simultaneous development. As mining progresses, the working area expands from the initial size of the split trench until its upper edge reaches the final contour of the quarry at the surface level. The development of the working area in depth continues until the final depth of the quarry is reached by mining operations.

Keywords: Open-pit mining, quarry, ledge, rock mass

Introduction

Open pit mining has been carried out in our country since ancient times. Currently, there are enterprises of large production capacity.

At the present stage of the formation of the country's market economy, the basis for the functioning and development of its mining industry is the open method of mining. Mining open method provides significantly better technical
economic performance than underground.

The working area is usually understood as that part of the surface of the open pit, in which the main technological processes of open pit mining are carried out during a given period of operation of the deposit. “It is a surface that moves and changes in size and shape, having a variety of spatial configuration and different time position in the space of a quarry field.

In fact, the working area of a quarry is, in terms of meaning and essence, a three-dimensional geometric figure, because Mining works are being carried out in it, and the reserves of rock mass that have been discovered and are ready for excavation are being formed. Mentioned can be made only in space. In connection with the above, there is a need to clarify the definition of the working area and develop analytical methods for calculating its parameters.

Proceeding from the essence of mining, the working area should be understood as that part of the open pit field in which, at the given moment in time, mining and

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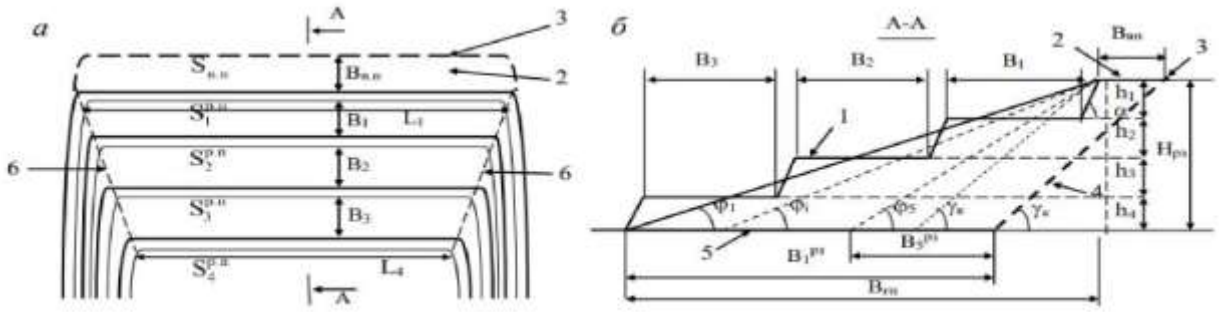
preparation, overburden and mining operations are being carried out or planned. With the development of mining operations in space and time, this part of the quarry is in constant motion and change, up to the setting of working ledges consistently in an intermediate or limiting position. So, with continuous longitudinal and transverse mining systems (ideally), the working zone performs a plane-parallel movement, with a deep mining system (the central part of the quarry is a rectangular parallelepiped) - a similar movement, but with a regular abrupt lowering to the height of the next opened horizon.

In the general case, the working area is a part of a quarry field that moves and changes in size and shape over time. It is limited from the mined-out space by the working side and the upper platform of the first working ledge with a width equal to the width of the heading along the pillar, from the quarry field in the direction of the development of mining operations by the current contour, from the unopened or non-working lower horizons by the base plane of the lower working ledge, and along the flanks - by the side faces (picture 1).

The working side of a quarry is a set of inclined surfaces of slopes of ledges and horizontal surfaces of work sites. Together with the upper platform of the first ledge, it forms an open surface of the working area. The current contour of the working area is a plane drawn through the back side of the upper platform of the first working ledge, parallel to the pit wall in the limit position. The lateral boundaries of the working area are a set of normal planes drawn along the ends of the length of the front of each ledge. The main parameters of the working area are: height, width, angle of slope of the working side of the open pit, the length of the front of each ledge, the area of the working platform, the projection of the working side on the horizontal plane and the volume of rock in it at a given time (picture 1).



Pict.1 The working area of the quarry in plan (a) and an enlarged section of the working area along
A-A (b):

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1 - working side, 2 - upper platform of the first working ledge, 3 - back side of the upper platform of the first working ledge, 4 - current contour, 5 - base and 6 - side boundaries of the working area

With the current level of use of computer technology, the calculation of areas and volumes of mine workings in the working area is not difficult. However, for a detailed analysis of the current and prospective state of mining in a quarry, it is necessary to have a mathematical model of the working zone. For this purpose, the latter along its length should be divided (by cross sections) into several (m) characteristic elementary sections and for each selected working section on its cross section, calculate the quantities of interest. Further, depending on the nature of the task, by averaging or summing them, you can find the necessary parameters of the working area as a whole.

That, the calculation formulas given below refer to the geological section of the working zone. To simplify the notation, the index "g" is omitted in them. It is known that the height of the working zone (H_{p3}) is equal to the sum of the heights (h_m) of the active (n) ledges that make up this zone, i.e.:

$$H_{p3} = \sum_{\mu=1}^{n} h_{\mu} .$$

All other necessary parameters of the working area with a known are functions of the angle of slope of the working side of the quarry. The latter indicator is usually determined by the angle of inclination of the line connecting the lower edge of the lower and upper edge of the upper working ledges to the horizon. This angle for the first position of the surface of the working area is calculated from the dependence:

$$tg\varphi_i = \sum_{\mu=1}^{n} h_{\mu} \Big/ \left(\sum_{\mu=1}^{n-1} B_{\mu} + \sum_{\mu=1}^{n} h_{\mu} ctg\alpha_{\mu} \right),$$

where B_{μ} is the width of the working platform on the ledge; and α_{μ} is the slope angle of the ledge. The denominator of expression (1.2) represents the projection of the working board on the horizontal plane, i.e.:

$$B_i^{p3} = H_{p3}(ctg\varphi_i - ctg\gamma_k) + B_{вп} ,$$

where γ_k-is the slope angle of the quarry wall in the limit position; $B_{вп}$ - the

with of the upper platform of the first working ledge. Cross-sectional area of the working area, representing the volume rocks of an elementary section of the working area for the first position surface of the working area, with sufficient accuracy can be found from expressions (pict.1)

Cross-sectional area of the working area, representing the volume rocks of an elementary section of the working area for the first position surface of the working area, with sufficient accuracy can be found from expressions (fig.1)

$$S_i = \frac{1}{2} H_{рз}^2 (ctg\varphi_i - ctg\gamma_k) + H_{рз} \cdot B_{вп},$$

$$S_i = \frac{1}{2} H_{рз}^i (B_{рз}^i + B_{вп}).$$

In the position of the working area, shown in Fig. 1, b, the area triangles of the lower three ledges that go beyond the contour of the working zones, compensate for the missing areas of the upper three ledges, which already taken into account when calculating the volume of the working area according to formula (1.4). The total areas of the mentioned triangles are almost equal. This pattern is valid for any number of working ledges, which confirms the validity of dependence (1.5). The eligibility of the specified, the relation can also be proved by direct measurements. At this cross-sectional area of the working area of the working area is calculated by summing the areas of sections of ledges included to the work area.

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