ANALYSIS OF FACTORS THAT AFFECT THE PRODUCTIVITY OF TECHNOLOGICAL EQUIPMENT IN THE BLOCK FACING STONE QUARRIES

**Introduction.** The productivity of technological equipment defines the volume of work performed per time unit by some unit of equipment according to its constructional features, technical characteristics and production qualification of workers. It is an essential element of the calculation of production capacity of enterprises, one of the major indicators of their effectiveness.

**The relevance of studying.** Nowadays there is an urgent need in achieving maximum production capacity in extraction of high-strength facing stone. For this purpose it is necessary to form the most productive technological complex of equipment, that will ensure the maximum efficiency of the quarry.

The productivity of each of the constituent parts of the complex directly affects the productivity of technological complexes. If the factors that determine the productivity of each link are known, it is possible to adjust the quantity and quality of the complexes and to achieve maximum production capacity in specific geological conditions. So, first of all, it is important to analyze the factors affecting the productivity of each of the units of technological equipment in the technological circuit.

**The presentation of the material.** Generally, distinction is made between passport, technical and exploitative productivity of individual machines and complex of equipment.

In general form the operating productivity of individual machines is usually determined by the expression:

\[ Q_{\text{oper}} = Q \times T \times K \]

where \( t \) is technical productivity of the machine with its continuous work; \( T \) is calendar period which is treated for determining the productivity; \( K_u \) is coefficient of using the machine over time.

The productivity of complexes and separate mining and transport machines depends upon many factors. It is possible to single out the following isolated groups.

**Natural factors.** Productivity of equipment is determined primarily by physical and mechanical properties of rocks (heaviness of development, destruction, drilling, blasting, excavation and transportation). Physical and mechanical properties of rocks affect primarily the speed of certain operations and technological processes, as well as they determine the dynamic stress on parts and components of equipment and their rate of deterioration. The heterogeneity of the structure of rock mass increases the dynamic load, duration of support operations and irregularity of their implementation.

Figure 1 shows a graph of the productivity of self-propelled drill such as Quarry Commando 120R in drilling wells to further cutting the assisted outcrop surfaces with the help of diamond rope installation.

![Fig. 1. The dependence of the productivity of drilling rigs on the high strength rocks](image1)

Figure 2 shows a graph of dependence of the productivity of diamond rope installations such as Marini Gran Fill Super on the strength of rocks.

![Fig. 2. The dependence of the productivity of diamond cutting rope installations on the strength of rocks](image2)
Consequently, the productivity of equipment in preparation for the separation of the monolith from the array decreases proportionally with increasing of rock strength.

The temperature conditions has a great importance. The resistance of rocks to removing increases at low temperatures. The frequency of accidents downtimes dramatically increases due to thickening of oils, changing the properties of metals and increasing dynamic loads on the working parts.

**Structural and production reliability of mining machines and mechanisms.** The lack of reliability of mining machinery characterized by a probability of working condition is a major cause of incomplete and insufficiently effective use of productive capacity of the park of mining machinery for quarries.

**Technological factors.** Parameters of the system development, transport schemes of quarry and road development of individual working scarps, the shape of the road, bows, distance transportation, etc. significantly affect the productivity of mining and transport equipment.

Productivity of diamond rope cutting is determined by the dependence:

\[
Q = k \cdot V \cdot L \cdot \frac{m^2}{hour}
\]

(2)

where \(k\) is coefficient, that takes into account the length of contact "breed-tool"; \(V\) is speed of cutting of high strength rocks with diamond rope equipment:

\[
V = 4.56 \cdot 10^{-4}(39,36 \cdot V_p - 0,06 \cdot q)
\]

(3)

where \(V_p\) is cutting speed (speed of rope motion), m/sec; \(q\) is a comprehensive hardness of rocks; \(L\) is length of notch, m.

So, exploitative productivity of diamond rope installation increases with the length of notch and speed of the rope movements. The exploitative productivity of submersible pneumatic hammers depends primarily on the operating pressure in the chamber of pneumatic hammers. The speed drilling of wells and expenses of air increase proportionally with increasing of operating pressure in pneumatic hammers.

Reducing the height of the ledge leads to more frequent movements of drilling, excavation and loading equipment. Therefore, exploitative productivity of drilling rigs increases with the length of the hole.

**Organizational factors** include the annual and daily work routine of equipment, terms for conducting prophylactic checkups and repairs, qualifications of staff, organization of maintenance and support services, planning and scheduling of mining processes in general etc.

**Conclusions:** The exploitative productivity of equipment for the preparation the monolith to the separation is primarily affected by natural (physical and mechanical properties of rocks, climatic conditions) and technological (parameters of monolith, technical characteristics of equipment) factors.