

BOREHOLE DRILLING PARAMETERS FOR DETERMINING THE OPTIMUM SIZE OF GRANITE STONE BLOCKS

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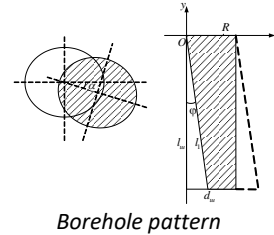
Extraction of natural stone in dimension stone quarries consist of different processes such as: drilling, blasting, splitting, cutting, crashing, excavation, etc. Dimension stones mining extraction technology is characterized by specific factors that aim to keep the physical and mechanical natural stone properties, get blocks with straight shape and effective commercial size.

Using technology of dimension stone extraction during the process of splitting blocks from the massif mostly the splitting methods by shims are used. In practice, the horizontal projections of the hole's tops and bottoms due to drilling deformation and borehole deviation, usually do not be projected one on one. In such case, it causes the formation of large rough surfaces after splitting on blocks surfaces, that result significant losses of stone in further processing operations. Incorrect position of the boreholes' bottom causes to unequal concentration of splitting tensions, which are results of diagonal fractures formation. It should be borne in mind that boreholes deviation from the design position causes an increase in the volume of drilling operations due to increase in the length of drilled boreholes. When using fracture-forming methods the deflection of boreholes axes causes a change in the geometry of splitting forces spreading, which effects on efficiency and quality of splitting and separation process.

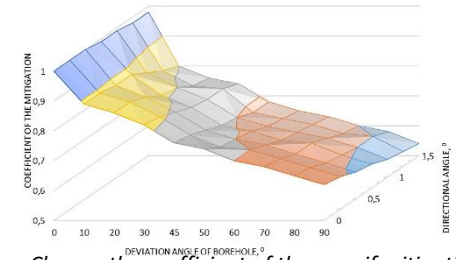
Borehole deviation when performing drilling operations for overall drilling of massif can cause to increased separation area, increased tool costs and poor quality of block production.



Splitted block by hydro shims



Borehole pattern



Change the coefficient of the massif mitigation

One of the most promising directions of improvement of extraction processes is optimization of drilling operating parameters, taking into account the natural fracturing, physical and mechanical properties stone.

The value of specific splitting area during the monolith preparation to the extraction will be less than the estimated, which effect to splitting parameters of blocks from massif. Therefore, such the overall quality index of drilling can be taken as a performance criterion of splitting blocks from the massif.

The values of tensions allow to analyse the conditions for creation crack for splitting blocks from massif. It should be borne in mind that destruction theory takes into account only the greatest tension, notwithstanding that other main tensions also have an effect on the achievement of the critical state. So, knowing the critical values σ_{cr} for an dimension stone massif, it can be determined the critical tension to initiate friction formation.

The quality of the stone preparation for splitting depends first of all on the plane of designed split-plane, the main characteristic of which is the specific value of splitting plane. As proved by the calculations, this value depends on the angle of borehole inclination. It was researched that boreholes have different values of deviations from vertical, which cause a decrease of the specific value of splitting plane, which depends on the azimuthal α and the zenith angles ϕ of hole axis along the designed split-line. It is obtained that the most negative values of the azimuthal angle α are observed in the range from 72° to 90° , and the zenith angle ϕ from $0,75^\circ$ to $1,4^\circ$.