EVALUATION OF THE STRENGTH OF ROCKS IN OPEN MINING PROCESSES IN MINING ENTERPRISES

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Abstract. *The article presents the results of experimental research on the strength properties of the rock mass used the results of studies on the assessment of slope stability in an open mine are presented. Formulas describing the correlation between the final and determined the residual strength and residual shear strength of rock samples along the failure surface. There is a new method it was developed to calculate the residual interface strength of rocks based on test data an experiment was carried out on small-sized monolithic samples with opposing technological indentors. A power estimation method is proposed characteristics of the rock mass near the fractured slope (structural attenuation coefficients and internal friction angles). The method relies on test data obtained from breaking small-sized monolithic samples with technological indentors, taking into account contact conditions along the weakening surface, and can be used in field conditions. The instability of the slope of open pit mines has a negative effect on the overall profitability of the mines, may also have safety and environmental impacts. Slope geometry has a decisive influence on the slope of an open pit, the quality of the rock mass and the presence of geological features and their characteristics should be studied. The purpose of this study is to show the method of choosing the optimal total slope angle of open pits and according to three design parameters, i.e. safety (e.g. probability of instability), performance (e.g. profit) and extraction costs (e.g. overburden removal costs). Therefore, this research attempts to a hybrid approach in which numerical modeling is combined with probabilistic analysis for estimation studies have been conducted on the stability of the open pit at different general slope angles. Two-dimensional elasto-plastic finite element was used to develop a series of models at different angles of slope. Crushing and crushing of rocks, we can observe the processes of using cutting force reduction techniques. The results show that mine profitability and overburden removal costs increase and the total slope angle decreases as it becomes steeper. However, the stability of the slope deteriorates. That is why, combining these three design parameters (such as security, performance, and cost) is highly recommended. It is necessary to pay attention when choosing the general slope angle of open pit mines.*

Keywords: *slope stability in mining enterprises, coefficient of strength of rock, open pit mines, techniques for reducing rock cutting force, open pit productivity.*

Introduction

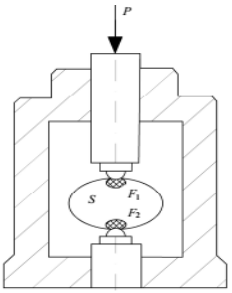
In the assessment of slope stability in open pit mines, the primary data is represented by the physical and mechanical properties of the rocks. However, their evaluation in field conditions turns out to be very labor-intensive, and high-level interpretation of the obtained results is a difficult process. Therefore, preliminary data are determined by correcting the results of laboratory tests for empirical correlations, taking into account the specific characteristics of rocks with unnecessarily large structural dimensions. In Uzbekistan, this phenomenon is characterized by the

term "rock strength coefficient", great attention is paid to the properties of contacts and attention should be paid to surface irregularities between cracks, especially those related to their expansion. Simultaneously with the development of computers and specialized software aimed at assessing the stability of open pit slopes, practical calculations are actively involved. It allows a more complete and detailed review of the structural composition of the rock mass in mining enterprises. A combined application of empirical correlations from a scale effect and modeling perspective slopes with detailed structural content can cause rock fractures to be counted twice. On the other hand, approaches to estimating the scale effect using numerical modeling are increasingly developing. The angle of inclination affects the calculation ratio more or less and resulting in mine profitability. Alternatively, the higher the clearance ratio, the more expensive mining and less profit is then achieved. Reduction in discharge ratio (e.g. removing less waste rock) requires maintaining the overall slope angle and as steep as possible (eg increasing ore extraction) is preferred. This requires successful pit planning and accurate knowledge of geology and site characteristics. The final design of the optimal slope angle is governed not only by the ore distribution and operating cost, but also determined by the characteristics of the total rock mass. Therefore it is recommended incorporating the potential for failure into the final open pit design. It helps to predict temporal and spatial actions is taken. Rock characteristics are important design input parameters. This the parameters are never precisely known. There are always uncertainties associated with this it is impossible to eliminate them. Some of these uncertainties exist due to limited data, testing errors, random data lack of collection and knowledge can cause problems. Here, probabilistic methods are introduced next section is used to resolve uncertainty associated with rock mass properties. Probabilistic methods are used to deal with the strength/structural variability associated with rock properties. They are used to estimate the probability of failure and different slope angles and measures will be necessary to reduce the risk to an acceptable level. This methods include statistical variation of numerical model input parameters and representing rock mass properties (eg, mean, variance, and standard deviation), as well as rock loss criteria are considered as design. Our focus in this study is the uncertainty arising from the properties of the rock mass.

The structure of the technology for calculating the strength of rocks

It was decided to use improved sample loading with indentation technology, which was experimented at the Nukus University of Mining, as the main test method for assessing rock strength. The main idea of the method is to test the sample, axial load until the first of the two steel balls breaks, to determine the destructive force P, measure fracture surface area S and surface areas in fractured rock zones of contact with F1 and F2 indentors, of which the largest - F - is selected (Picture. 1). As received experimental data, sample elimination sample is accepted, the strength of the rock describes the mechanical behavior of the mass and complex rock causes a state of stress. During disintegration, three different destruction mechanisms are activated in the sample: the indenters and the nearby "technological pressure effect" behavior and fracture and shear mechanisms at boundaries are considered. The main method of drawing up a rock strength certificate involves the calculation of coordinates for the characteristic points of the envelope and the parameters of the strength certificate using functional properties that determine the destruction of the rock mass. The tension st and compression p components of the ultimate shear resistance in the absence of normal stress are assumed. Otelbayev Azizbek, a student of the Nukus Mining Institute, proposes the processes of approximate determination of the envelope of stress circles in

the coordinate system. Rock with the correct intervals corresponding to the forms of permanent deterioration - fracture, shearing, under high non-uniform 3D compression, the "structural deterioration" of the rock is reduced.



Picture 1. The structure of the technology for determining the strength coefficient of a rock sample with indenter technologies.

The crushing strength of the rocks along the contacts was compared and it was found that the impact strength of the rocks is the smallest of the parameters. Difference between rock strength and fractured rock residual strength increases. Comparison results between final and residual strength of monolithic rock obtained calculated using the results of spherical indicator tests. Demonstrates the application of calculating the ultimate and residual strength using a straight-line approximation of the envelope segment corresponding to the shear mechanism of rock volume tests and estimated parameters. For wide-range comparisons, ultimate stresses must be calculated.

Conclusions

Information on the strength characteristics of the rock mass calculated according to the method recommended in the article without a detailed study of the weakened surface features, they are inherently complex processes and are associated with the initial stages of object inspection. By collecting data on the actual parameters of the weakened surfaces in natural conditions and in the process, the calculated values of the rock strength properties should be determined. The described method is technically applied in the field using a simple loader. It is acceptable to use samples of irregular shape in tests. With an increase in concentration from 0 to 0.4%, the surface tension of surfactants decreases from 73.5 to 30 × 10 3 N / m. The results obtained show that the surface tension of the surfactants studied at a concentration of more than 0.1-0.2% decreases almost slightly. The laws of variation of surface tension of the concentration of surfactants of the types CF-8201, OP-10 and V-87 are characterized by the dependence of the hyperbolic type. As the concentration increases from 0 to 0.4%, the refractive index, hydrogen index, and electrical conductivity of surfactants such as CF-8201, OP-10, V87, and Soapstock decrease. The results show that the refractive index, hydrogen index and electrical conductivity of surfactants such as CF-8201, OP-10, V-87 and Soapstock have a minimum value at a concentration of more than 0.2%. A further increase in concentration is accompanied by a refractive index of hydrogen and an increase in electrical conductivity. The resulting pattern is characterized by parabolic results. The regularity of the refractive index of surfactants of the Soapstock type to their concentration is characterized by a linear type dependence. Otelbayev Azizbek(azikalisherovich2001@gmail.com, https://orcid.org/0000-0003-2091-7978) a student of Nukus Mining Institute under the Navoi State University of Mining and Technologies, has conducted many researches and scientific works on the activities of mining enterprises. Azizbek's interest in activities in mining enterprises is high, he is mainly interested in processes based on metallurgy, chemical technologies in mines, the scheme of metal melting furnaces, processes in mines.

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