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Determination of the suitable shape of pillars in the stope and pillar method using numerical modeling, Case study: Faryab Chromite mine

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ABSTRACT

One of the most important factors in the extraction of minerals obtains the maximum benefit. The extraction of minerals is benefit when the more minerals extracted with considering of the technical conditions. In this study, using Flac3D and strain plasticity model, the shape of pillars in Faryab Chromite mine is optimized. In this regard, the pillar of the cylindrical shape was modeled and then the diameter of the cylinder in the middle of the pillar was decreased. The most suitable shape of pillars was obtained with a diameter of the middle 8.6 m and the diameter of the upper and lower 8.8 m.

KEYWORDS:

Numerical modeling, Pillar design, Model strain plasticity, Flac3D Software.

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1- Introduction

Stop and pillar mining is the most common underground methods extraction non-coal deposits. In this method for create Space Exploration remains part of the mineral pillars . Proper design and optimization shape pillar on Economical design and safety workshops and mining operations and recovery doublets is affect. In principle The pillar design should be load on the pillar, pillar strength, safety the main factor considered in the design. To calculate the strength of pillar has a lot of analytical and experimental method shave been proposed, However, these methods have disadvantages are simple, Which today designers tend to use numerical methods to estimate increased pillar resistance. Pillars design are they from impressionable. The relationship between the pillars shape and its strength has been discussed by many researchers [1,2].

In this research, for the first time with study effect decries or increase middle diameter and upper diameter in resistance and finally determine optimize shape pillar in stop and pillar method with use software FLAC3D. for this purpose, Described the general method of problem solving and then been investigated how pillar failure with to consider the behavior soft strains (Use Mohr-Coulomb model Softness curving). In order to investigation behavior pillar and verdict about resistance it, there point in middle pillar height as failure critical point pillar, located along x axis in figure (1) and The amount of stress in these areas was monitored and recorded.

2- Numerical Analysis

Faryab chromite mine in the current scheme includes workshops with a square pillar with

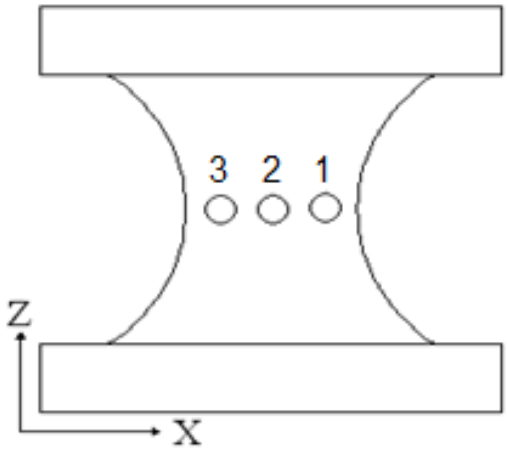

Figure 1. The monitoring locations tension inside the pillar

dimensions 8 × 8 m and a height of 12 m, Volume equal to 768 cubic meters is done. New pillar Must be chosen In addition to lower volumes also have the ability to load. For this purpose, The pillar cylindrical shape selected and then their form has been changed gradually from cylinder to cylinder Hyperbolic. To display the pillar geometries, Diameter cross-sectional area has been shown in the center of the pillar with di and at both ends of the pillar in the high waist and low waist with do. According to this, pillars were designed and analyzed with different Specifications and Models. Finally, The pillar hyperbolic cylindrical shape with 6.8 m diameter middle and 8.8m Upper and lower diameters was appropriate. Histogram stress on points 1, 2 and 3 pillar in the figure (2) is shown.

At the end, Using the proposed method, The shape and dimensions suitable Chromite mineral pillar in faryab, With the extraction Stop and pillar method.

In figure 3, The maximum stress on each of the 7 pillar investigated in this study it is shown. This

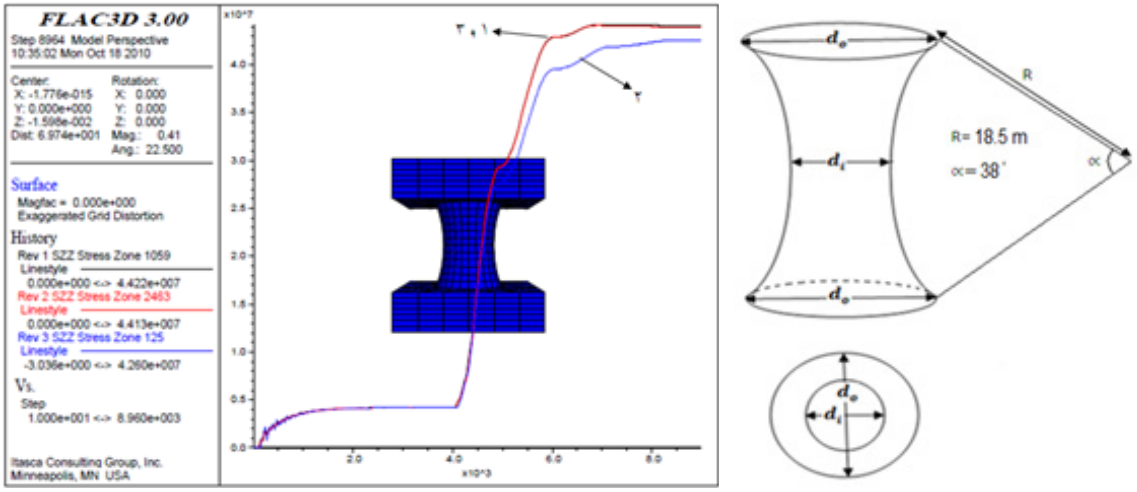

Figure 2. Histogram stress on the pillar into a cylindrical shape Hyperbolic with middle diameter 6.8 m and upper and down diameter 8.8 m

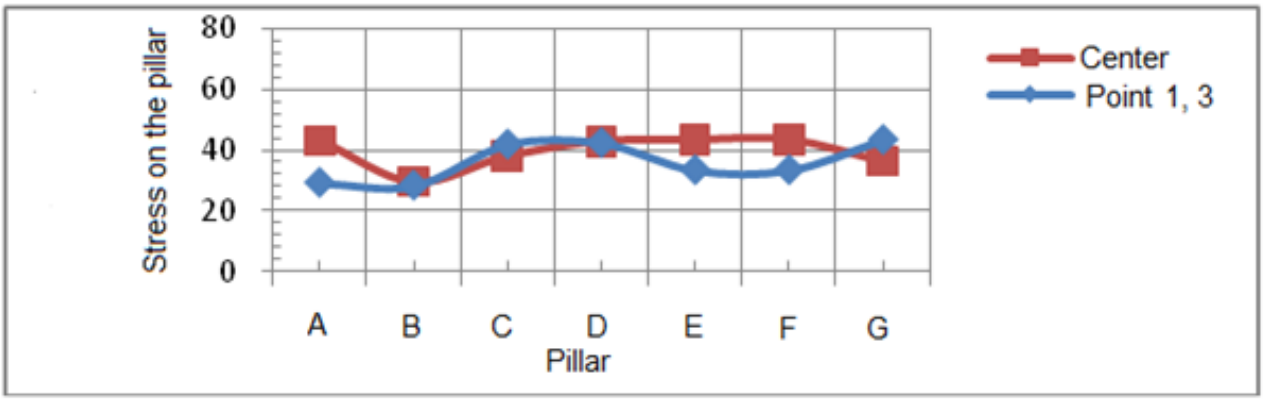

Figure 3. Stress on the basic points regarding the selection process of optimal diameter

curve been drawn due to the marked spots in different parts of the pillar. As can be seen, in between the pillars of sustainable, pillar "d" the best conditions of stress distribution is evaluated in points. According to figure 4, this pillar in the between stable pillars is the lowest volume.

3- Conclusion

According to done designed, volume of chromite pillar Faryab mine decries from 768 cubic meters to 528 cubic meters. This decline leading to Increase retrieval pillars, the amount of about 45% in the first stage mining. According to the high selling price chromite, this increase retrieval is very important.

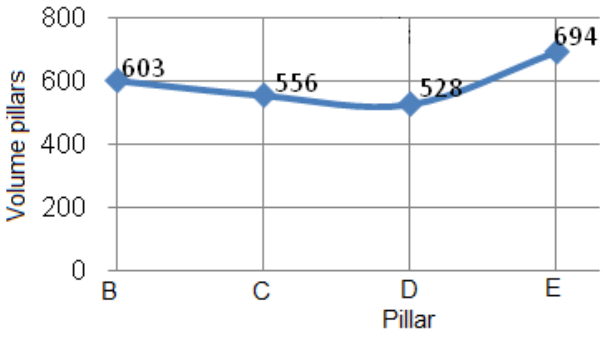

Figure 4. The volume change stable pillars according to change in middle, upper and down diameter

4- References

[1] Jeremic, M. L.; "Ground mechanics in hard rock mining," Latin Book of Rock mechanics Publisher, A. A. Balkema, p. 537, 1987.

[2] Maybee, G. W.; "Pillar design in hard brittle rocks," Thesis submitted in partial fulfillment of the requiretnent for the degree of Master of Applied.