Study on the Stability of Main Adit in Cut and Fill Mining System at Bawsaing Mine, Myanmar

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1. Introduction

Bawsaing mine is the Pb-Zn-Ag mine and located in the eastern part of Miramar. The research area of this mine is shallow depth and the main adit is developed from toe of the slope as shown in Figure 1. In underground mine, the stability of main adit is very important and it depends on the rock mass conditions. As the rock mass conditions of this area are highly jointed and weathered, ground control problems have occurred such as the roof fall and rib failure of the main adit. Moreover, once mining operation with cut and fill method will start, the stope also has an obvious impact on the stability of main adit. Therefore, in order to maintain the main adit and success mining operation in shallow area, this research discusses the appropriate support system and design of the main adit considering the effect of extraction by cut and fill method by means of field investigation and numerical analysis.

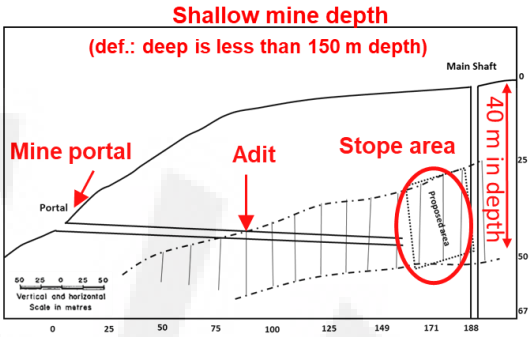

Figure 1. Research area of shallow main adit

2. Research Methodology

Three dimensional continuum modeling code FLAC3D which utilizes an explicit finite difference formulation was used in this research. Figure 2 shows the numerical model. From the assessment of rock mass condition based on the results of site investigation and a series of laboratory tests by using core samples, and geological conditions, the GSI (Geological Strength Index) value of this research area is estimated around 30 and the rock mass condition is classified as poor conditions. Table 1 represents the mechanical properties of rock mass used in this numerical analysis. As the support system, timber support and steel sets are considered in this research. The Mohr-Coulomb criterion is employed as the failure criterion.

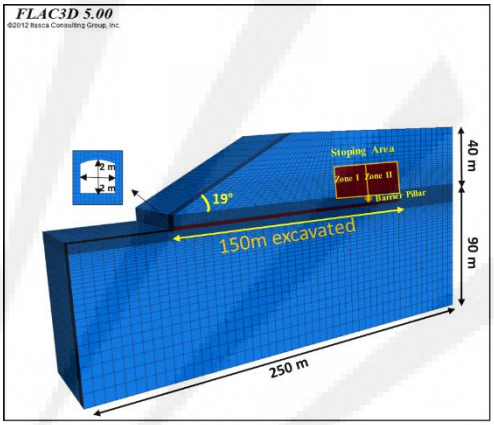

Figure 2. Numerical model

3. Results and Discussions

Figure 3 shows the distribution of failure zone around the main adit supported by steel arch with 1.0m spacing at 5 m, 15 m, 25 m depth from the mine portal. From these results, it can be said that the main adit can be maintained by installation of steel arch inside of the adit entrance. On the other hand, the severe failure can be expected around the portal due to the large shear strain occurs around the toe of the slope. Hence, additional supports such as concrete lining and/or rock bolt should be applied around the portal.

Table 1. Mechanical properties of rock

Parameter	Rock	Filling material
Uniaxial compressive stress (MPa)	0.006	-
Density (Kg/m^3)	2738	-
Young's modulus (MPa)	1000	1000
Poisson's ratio	0.25	0.25
Friction angle (º)	38.81	20.5
Cohesion (MPa)	0.2	0.2

The stope extracted by cut and fill method has an obvious impact on the stability of the main adit as shown in Figure 4. the barrier pillar with 3m or more width should be left between the stope and the main adit supported by steel arch with 1.0 m spacing.

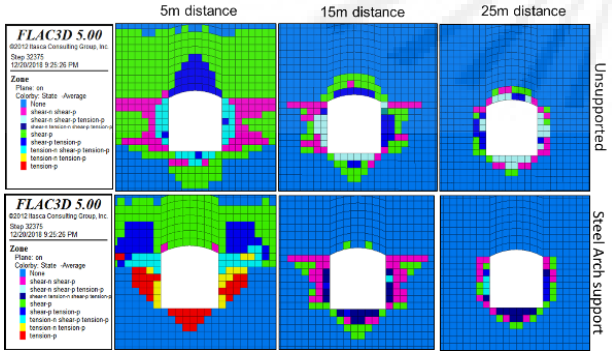

Figure 3. The failure zone of 5 m, 15 m, and 25 m distance from the entrance of adit compared with unsupported and steel arch support.

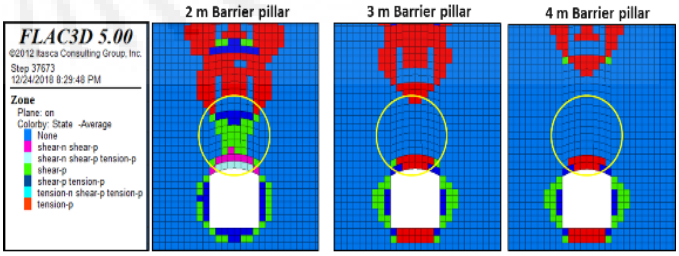

Figure 4. Failure zone under different barrier pillar (the main adit is supported by steel arch with 1.0m spacing)