Evaluation on Slope Stability in Lowwall with Saturated Bedding Shear and Its Countermeasure

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ABSTRACT

1. Introduction

Berau Coal mine is open pit coal mine located in Berau, East Kalimantan, Indonesia. Currently, plane failure was occurred in lowwall slope on Pit C2 as the one of mining optimization area which triggered by rainfall event before the failure time. The lowwall slope was monitored by Slope Stability Radar (SSR), so the failure pattern was recorded in SSRViewer and the failure back analysis can be discovered to understand the failure behavior of the lowwall slope. In this research, will learn the relationship of rock mass strength to the saturation as the effect of rainfall by variation of Young's modulus and variation of groundwater level using numerical modelling and discuss the countermeasure to handle the failure by numerical simulation and suggest the most optimum countermeasure based on safety and economical aspect.

2. Data and Methods

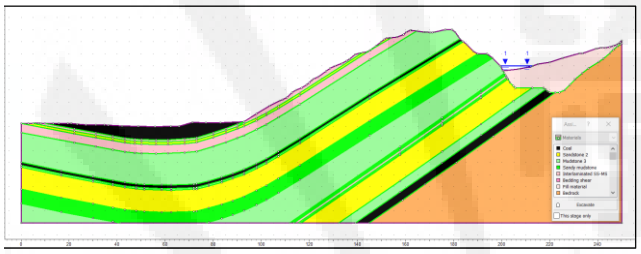

Figure 1. Lowwall slope design on pit C2 site Sambarata Mine Operation

In this research, failure mechanism and failure behavior of plane failure on lowwall slope was carried out from SSR monitoring data such as deformation, velocity, and invers velocity data by plotting as the graphics. The numerical simulation starts from design the lowwall slope (Figure 1) which done by Phase2 software. Furthermore, the variation of Young's modulus (E) of material would be conducted to understand the effect of E to the total displacement of slope. Likewise, the variation of groundwater level was also carried out to understand the effect of groundwater level to critical SRF. From the slope model, and result of E variation and groundwater level variation, some countermeasures were analyzed to handle the slope failure and suggested the most optimum countermeasure by minimum critical SRF was 1.3 and most minimum cost of countermeasure.

3. Results

Plane failure that was triggered by rainfall event can causes the interlaminated sandstone – mudstone material formed saturated bedding shear. By the numerical modelling result, Young's modulus as the rock mass strength parameter had influence on the slope stability, value of maximum total displacement by numerical calculation approaching maximum deformation by SSR monitoring data when the E of material reduced by 15% that around 125 mm (Figure 2). The variation groundwater level result shown the lowwall slope was going to unstable when the groundwater level was higher than 35 meters (Figure 3). There was some countermeasure to handle the plane failure on the lowwall slope such as removing bedding shear material, reducing overall slope angle, dewatering by horizontal drains and counterweight on slope toe. Based on the safety and economical aspect, the most optimum countermeasure is removing bedding shear material. Dewatering by horizontal drains also highly recommended, but it needs further research about the exact number of holes needed and the design of drain holes to get the effective result of dewatering.

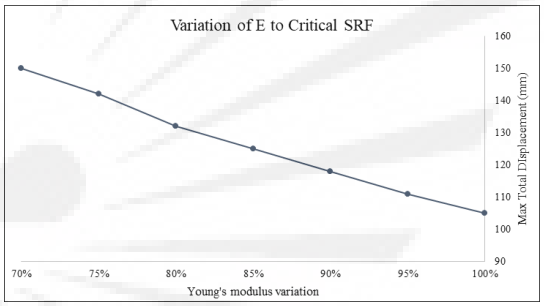

Figure 2. Variation of Young's modulus to the maximum displacement of lowwall slope.

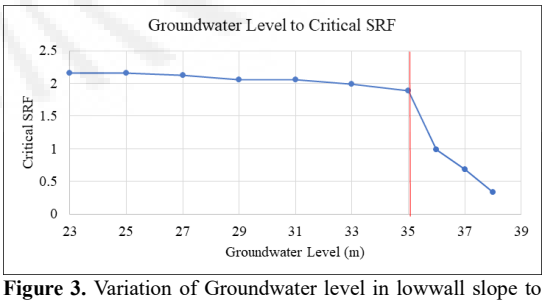

Figure 3. Variation of Groundwater level in lowwall slope to critical SRF