SUMMARY

PT Gorby Putra Utama is a company engaged in the mining industry with coal as the commodity, located in Bingin Makmur Village, Rawas Ilir District, North Musi Rawas Regency, South Sumatra Province. PT Gorby Putra Utama is currently involved in mining activities. The mining process has resulted in the formation of a slope. The mining activities in the southern pit are planned until the year 2030, and with the designated mining period, there is a need for a final pit design. Therefore, PT Gorby Putra Utama has developed a final pit design by forming a highwall slope with a height of 110 meters and a slope angle of 41 degrees. The single slope geometry consists of a bench height of 10 meters, a bench width of 6.0 meters, and a slope angle of 59-60 degrees. The final design has undergone analysis, resulting in a Factor of Safety (FS) value of 1.666 and a Probability of Failure (PF) value of 0.00%. According to Minister of Energy and Mineral Resources Decree No. 1827K/30/MEM/2018, the specified limits are Factor of Safety ≥ 1.3 and Probability of Failure (PL) ≤ 5% for the overall slope. With this knowledge of the limits, the existing final slope design can still be optimized to approach the specified limits. The optimization is carried out to increase the coal reserves quantity of PT Gorby Putra Utama.

The slope stability analysis is conducted using the limit equilibrium method, employing approaches such as Bishop Simplified, Janbu Simplified, Janbu Corrected, Spencer, and Morgenstern-Price methods. Meanwhile, the analysis of landslide probability utilizes the Monte Carlo method for its sampling approach. Material properties utilized include bulk density, cohesion, internal friction angle, and uniaxial compressive strength. The criteria for failure used is the Mohr-Coulomb criterion. Groundwater conditions are assumed to be saturated due to the lack of precise groundwater level data in the research area.

Based on the conducted analysis, the highwall slope design can be optimized with an optimal geometry, which includes a single bench height of 10 meters, a bench width of 5.5 meters, and a single slope angle of 63 degrees. With this geometry, the final highwall slope design undergoes changes in terms of the overall slope angle, Factor of Safety (FS) values, and Probability of Failure (PF) values. The overall slope angle changes from the initial 41 degrees to 44 degrees, the FS values decrease across all analysis methods: Bishop Simplified from 1.666 to 1.579, Janbu Simplified from 1.398 to 1.319, Janbu Corrected from 1.509 to 1.423, Spencer from 1.719 to 1.626, and Morgenstern-Price from 1.712 to 1.627. The PF values experience an increase in the Janbu Simplified method from 1.50% to 2.90% and in the Janbu Corrected method from 0.40% to 0.80%. As a result of these changes, coal reserves that were previously untapped can now be exploited.

Keywords: Geometry Optimization, Limit Equilibrium Method, Factor of Safety