

## INTISARI

Kestabilan lereng menjadi perhatian utama dalam operasional tambang terbuka, khususnya di lereng dinding barat Tambang Batu Hijau milik PT Amman Mineral Nusa Tenggara, yang telah mencapai kedalaman  $\pm 1000$  m dan diameter  $\pm 2$  km. Berdasarkan laporan geoteknik internal, terjadi peningkatan kejadian longsoran dalam satu tahun terakhir, terutama dipicu oleh kontrol struktur geologi berupa sesar aktif dan kekar yang intensif. Penelitian ini bertujuan untuk memodelkan kestabilan lereng secara tiga dimensi dengan mempertimbangkan dua parameter utama: karakteristik mekanik *clay gouge* dan kekasaran bidang kekar. Pemetaan struktur dilakukan menggunakan metode window mapping sepanjang 50 meter per lintasan serta spatial mapping berbasis fotogrametri. Karakterisasi *clay gouge* dilakukan dengan uji direct shear dan X-Ray Diffraction (XRD), yang mengidentifikasi mineral utama berupa *smectite*, *illite*, dan *kaolinite*. Nilai kohesi residual *clay gouge* adalah 0 kPa dan sudut geser dalam  $11^{\circ}$ – $14^{\circ}$ . Analisis kekasaran bidang kekar dilakukan dengan fotogrametri digital, menghasilkan nilai *Joint Roughness Coefficient* (JRC) antara 11.91–16.3, tergantung jenis dan orientasi kekar. Data orientasi kekar kemudian dianalisis dengan teknik *k-means clustering*, menghasilkan 7 set kekar dominan dengan orientasi Barat Laut – Tenggara dan Timur Laut – Barat Daya. Simulasi kestabilan menggunakan perangkat lunak *RocSlope 3D* menunjukkan bahwa nilai faktor keamanan (FK) statis dan dinamis bervariasi antara 1.243 dan 1.203 dengan nilai minimum terjadi pada area *clay-rich fault zone*. Blok-blok dengan  $FK < 1.3$  diidentifikasi sebagai zona kritis dengan potensi keruntuhan tipe *wedge failure*. Penelitian ini menyimpulkan bahwa struktur geologi, khususnya sifat mekanik *clay gouge* yang rendah dan kekasaran kekar yang rendah akan memiliki pengaruh signifikan terhadap kestabilan lereng. Hasil ini diharapkan dapat menjadi acuan dalam optimasi desain lereng dan sistem mitigasi risiko geoteknik di Tambang Batu Hijau.

**Kata kunci:** kestabilan lereng, *clay gouge*, kekasaran kekar, *RocSlope*, faktor keamanan, Tambang Batu Hijau.

## ***ABSTRACT***

*Slope stability is a primary concern in open-pit mining operations, particularly on the western pit wall of the Batu Hijau Mine operated by PT Amman Mineral Nusa Tenggara, which has reached a depth of approximately  $\pm 1000$  meters and a diameter of  $\pm 2$  kilometers. According to internal geotechnical reports, landslide incidents have increased over the past year, primarily triggered by structural geological controls such as active faults and intensive jointing. This study aims to model slope stability in three dimensions by considering two key parameters: the mechanical characteristics of clay gouge and joint surface roughness. Structural mapping was conducted using the window mapping method at 50-meter intervals per traverse and spatial mapping based on photogrammetry. Clay gouge characterization was performed using direct shear testing and X-ray Diffraction (XRD), which identified the main minerals as smectite, illite, and kaolinite. The residual cohesion of the clay gouge was found to be 0 kPa, with an internal friction angle ranging from  $11^\circ$  to  $14^\circ$ . Joint roughness analysis, conducted through digital photogrammetry, yielded Joint Roughness Coefficient (JRC) values ranging from 11.91 to 16.3, depending on the joint type and orientation. Joint orientation data were further analyzed using k-means clustering, resulting in 7 dominant joint sets trending Northwest–Southeast and Northeast–Southwest. Slope stability simulations using RocSlope 3D software indicated that the static and dynamic factor of safety (FoS) values ranged from 1.243 to 1.203, with the minimum value observed in the clay-rich fault zone. Blocks with  $FoS < 1.3$  were identified as critical zones with a potential for wedge-type failures. This study concludes that geological structures—particularly the low mechanical strength of clay gouge and low joint surface roughness—have a significant impact on slope stability. The findings are expected to serve as a reference for optimizing slope design and geotechnical risk mitigation strategies at the Batu Hijau Mine..*

**Keywords:** *slope stability, clay gouge, roughness, RocSlope, factor of safety, Batu Hijau Mine.*