

INTISARI

PT Bukit Asam Tbk merupakan perusahaan pertambangan batubara yang menerapkan sistem tambang terbuka, sehingga menghasilkan material buangan yang ditimbun kembali sebagai material timbunan. Material ini memiliki sifat geoteknik yang heterogen akibat proses penimbunan dan pelapukan, sehingga berpotensi memengaruhi kestabilan lereng. Pada lokasi penelitian, penggalian ulang dilakukan untuk mengambil cadangan batubara yang masih ekonomis di bawah material timbunan tersebut. Penelitian ini bertujuan untuk memperoleh batasan kepadatan tanah timbunan melalui pemodelan 3D berbasis data N-SPT, mengidentifikasi kondisi geologi teknik, mengevaluasi tingkat keamanan lereng berdasarkan Keputusan Menteri ESDM RI No. 1827 K/30/MEM/2018 dalam kondisi dinamis, serta memberikan rekomendasi desain geometri lereng yang aman dan sesuai standar. Pemodelan 3D digunakan untuk menggambarkan persebaran kepadatan tanah bawah permukaan sehingga analisis kestabilan dapat dilakukan lebih representatif. Metode penelitian meliputi analisis aspek geomorfologi, litologi permukaan, struktur geologi dan kondisi air tanah dengan memanfaatkan data sekunder berupa desain tambang, topografi aktual dan hasil uji *Standard Penetration Test* (SPT), serta pengamatan lapangan. Analisis kestabilan dilakukan menggunakan metode kesetimbangan batas *Morgenstern-Price* melalui perangkat lunak *GeosStudio Slope/W 2023.1* dengan mempertimbangkan beban luar berupa beban tambahan dari alat berat dan beban getaran akibat peledakan. Hasil penelitian menunjukkan bahwa daerah penelitian didominasi oleh lereng miring hingga sangat curam dengan litologi utama batulempung, batulanau, dan batubara. Struktur geologi yang teridentifikasi berarah barat laut-tenggara (NW-SE), dan timur laut-barat daya (NE-SW) sesuai dengan arah struktur regional Cekungan Sumatera Selatan. Nilai faktor keamanan lereng menunjukkan variasi pada beberapa penampang, sebagian lereng telah memenuhi standar keamanan, sementara penampang lainnya memerlukan penyesuaian geometri untuk meningkatkan kestabilan. Korelasi antara nilai N-SPT dan kuat geser tanah (S_u) menunjukkan kesesuaian dengan data laboratorium dan dapat digunakan sebagai estimasi awal analisis kestabilan lereng.

Kata kunci: PT Bukit Asam Tbk., Kestabilan lereng, material timbunan, N-SPT, pemodelan 3D, metode kesetimbangan batas

ABSTRACT

PT Bukit Asam Tbk is a coal mining company that implements an open pit mining system, producing waste material that is re-deposited as overburden. This material has heterogeneous geotechnical properties due to the deposition and weathering processes, which can potentially affect slope stability. At the research site, re-excavation was carried out to extract economically viable coal reserves beneath the overburden material. This study aims to obtain the density limits of the backfill soil through 3D modeling based on N-SPT data, identify the engineering geological conditions, evaluate the slope safety level based on the Decree of the Minister of Energy and Mineral Resources of the Republic of Indonesia No. 1827 K/30/MEM/2018 in dynamic conditions, and provide recommendations for a safe and standard-compliant slope geometry design. 3D modeling is used to describe the distribution of subsurface soil density so that stability analysis can be carried out more representatively. The research methods include analysis of geomorphological aspects, surface lithology, geological structure, and groundwater conditions by utilizing secondary data in the form of mine designs, actual topography, and Standard Penetration Test (SPT) results, as well as field observations. Stability analysis was performed using the Morgenstern-Price limit equilibrium method through GeosStudio Slope/W 2023.1 software, taking into account external loads in the form of additional loads from heavy equipment and vibration loads due to blasting. The results of the study show that the study area is dominated by sloping to very steep slopes with the main lithology being claystone, sandstone, and coal. The identified geological structures are northwest-southeast (NW-SE) and northeast-southwest (NE-SW) in direction, in accordance with the direction of the regional structure of the South Sumatra Basin. Slope safety factor values show variation in several cross-sections; some slopes meet safety standards, while others require geometric adjustments to improve stability. The correlation between N-SPT values and soil shear strength (S_u) is consistent with laboratory data and can be used as an initial estimate for slope stability analysis.

Keywords: *PT. Bukit Asam Tbk., Slope stability, overburden material, N-SPT, 3D modeling, limit equilibrium method*