INTISARI

Pengukuran volume *stockpile* penting dalam pertambangan karena menjadi dasar laporan produksi dan keuangan sehingga akurasi sangat diperlukan. Teknologi *Terrestrial Laser Scanner* (TLS) memungkinkan pengambilan data spasial dengan cepat dan presisi, namun menghasilkan *point cloud* berukuran besar yang memerlukan perangkat lunak pengolahan yang memadai serta metode perhitungan yang efektif dan akurat. Beberapa metode perhitungan yang dapat digunakan, diantaranya yaitu metode prismoidal yang terdapat pada perangkat lunak 12d Model dan metode unit area yang terdapat pada perangkat lunak Global Mapper. Mengingat perhitungan volume sangat penting dalam perhitungan stockpile, perlu diketahui perbedaan hasil dari kedua metode tersebut.Penelitian ini bertujuan untuk menanalisis perbedaan hasil perhitungan volume *stockpile* menggunakan metode prismoidal dan unit area menggunakan data hasil pengukuran TLS.

Pengukuran area *stockpile* dilakukan dengan *Terrestrial Laser Scanner* (TLS) menggunakan metode *cloud to cloud*, sehingga diperlukan data GNSS RTK untuk mendefinisikan koordinat tanah pada titik berdirinya alat. Posisi alat ditempatkan di beberapa lokasi sesuai bentuk permukaan *stockpile* agar mencakup seluruh area. Hasil pengukuran TLS yang berupa *point cloud* dilakukan registrasi dan *filtering* agar dapat digunakan dalam proses perhitungan volume tanpa ada data anomali di luar area penelitian. Selanjutnya data tersebut dihitung volumenya dengan metode unit area dan prismoidal. Perhitungan volume dilakukan dengan membagi area *stockpile* menjadi beberapa luasan: area keseluruhan, besar, sedang, dan kecil. Analisis perbandingan hasil perhitungan volume dari kedua metode dilakukan menggunakan standar ASTM dan uji statistik t berpasangan.

Hasil penelitian ini menunjukkan persentase selisih perhitungan volume antara metode prismoidal pada perangkat lunak 12d Model dan metode unit area pada perangkat lunak Global Mapper secara keseluruhan tidak masuk toleransi standar ASTM. Batas toleransi standar ASTM adalah 2,78%. Perbedaan volume pada kategori area keseluruhan (luas 30372,40 m^2) dan area besar luas (±15186,20 m^2) memenuhi standar ASTM, sedangkan pada kategori area sedang (±7593.10 m^2) dan area kecil (±3796.55 m^2) perbedaan volume tidak memenuhi toleransi standar ASTM. Namun demikian hasil uji statistik menunjukkan bahwa pada semua kategori area, volume hasil perhitungan kedua metode berbeda signifikan. Secara umum perhitungan dengan metode unit area menghasilkan nilai volume yang lebih besar dibandingkan perhitungan volume dengan prismoidal. Adanya perbedaan hasil yang signifikan ini disebabkan karena proses pembuatan DTM menggunakan metode yang berbeda dan metode perhitungan volume yang berbeda juga.

Kata Kunci: Volume *Stockpile, Terrestrial Laser Scanner* (TLS), DTM, *Volume* Unit area, Prismoidal, ASTM, Uji Statistik

ABSTRACT

Stockpile volume measurement is a crucial role in mining activities as it serves as the basis for production and financial reporting, therefore high accuracy is essential. Terrestrial Laser Scanner (TLS) technology enables rapid and precise acquisition of spatial data, however it produces large point cloud datasets that require adequate data processing software effective and accurate volume calculation methods. Several volume calculation methods can be applied, including the prismoidal method with 12d Model software and the unit area method with Global Mapper software. Considering the importance of volume calculation in stockpile assessment, it is necessary to identify and analyze the differences in results obtained from these two methods. This study aims to analyze the differences in stockpile volume calculation results using the prismoidal and unit area methods based on TLS measurement data.

Stockpile area measurement was conducted using a Terrestrial Laser Scanner (TLS) with the cloud to cloud registration method, therefore GNSS RTK data were required to define ground coordinates at the instrument setup points. The scanner was positioned at several locations according to the stockpile surface geometry to ensure complete coverage of the study area. The TLS measurement results, in the form of point cloud data, were subjected to registration and filtering processes to eliminate anomalous data outside the study area prior to volume calculation. Subsequently, the processed data were used to calculate volume using both the unit area and prismoidal methods. Volume calculations were performed by dividing the stockpile area into several categories: overall area, large area, medium area, and small area. Comparative analysis of the volume calculation results from both methods was conducted using the ASTM standard and paired *t*-test statistical analysis.

The results of this study indicate that the overall percentage difference in volume calculation between the prismoidal method in 12d Model and the unit area method in Global Mapper does not fall within the ASTM tolerance standard. The ASTM tolerance limit is 2.78%. Volume differences for the overall area category (area of 30372.40 m²) and the large area category (±15186.20 m²) meet the ASTM standard, whereas the medium area (±7593.10 m²) and small area (±3796.55 m²) categories do not satisfy the ASTM tolerance. Nevertheless, the statistical test results show that across all area categories, there are significant differences in volume between two methods volume calculation. In general, the unit area method produces larger volume values than the prismoidal method. These significant differences are attributed to variations in the DTM generation process and the differing principles underlying each volume calculation method.

Keywords: Stockpile Volume, Terrestrial Laser Scanner (TLS), DTM, *Volume* Unit area, Prismoidal, ASTM, Statistical Test