Utilisation of GNSS and UAV Technologies in the Generation of the Design Model and Construction of a Greenfield Tailings Storage Facility - Using Tokadeh TSF as a Case Study

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Key words: Access to land; Capacity building; Cost management; Education; Engineering survey; Geoinformation/GI; GNSS/GPS; Land management; Mine surveying; Photogrammetry; Positioning; Remote sensing; Spatial planning; Geodetic Control Networks

SUMMARY

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Keywords: GNSS Technology, Tailings Storage Facility (TSF), Digital Terrain Model (DTM), Real-Time Kinematic (RTK), Geodetic Control Networks, Unmanned Aerial Vehicle (UAV)

SUMMARY

This conference paper explores the application of Global Navigation Satellite System (GNSS) and Unmanned Aerial Vehicle (UAV) technologies in the generation of a design model and the subsequent construction of a greenfield Tailings Storage Facility (TSF) in Tokadeh Liberia. As TSF is a critical infrastructure in mining, its design modeling and construction require the usage of high precision survey techniques from project conception to commissioning.

Global Navigation Satellite System (GNSS) plays a critical role in surveying and mapping activities due to its capability of providing precise positioning, all-weather suitability, accessibility in any part of the world. GNSS significantly improves upon traditional surveying methods by offering high accuracy, ease of operation, and increased efficiency (Jiang & Zhao, 2023)

With the aid of GNSS and UAV technology these objectives can be achieved by providing high accuracy of works.

In addition, with the use of

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GNSS and UAV technologies including Real-Time Kinematic (RTK) and Post-Processing Kinematic (PPK) systems, we were able to achieve centimeter-level accuracy in geospatial data collection. This data was processed into a high-resolution Digital Terrain Model (DTM), enabling accurate volumetric analyses, slope design, and the boundary of the construction area. Quality assurance protocols were embedded at every stage, ensuring consistency and accuracy through redundant measurements, baseline validations, and integration with traditional surveying techniques.

The project began by deploying both GNSS receivers and UAV systems to capture high-precision geospatial data for the TSF site – the site delineated for the construction of the dams and other facilities.

Utilizing Real-Time Kinematic (RTK) and Post-Processing Kinematic (PPK) solutions, the team was able to achieve centimeter-level accuracy in data collection.

These systems, supported by the high precision survey techniques and a number of redundant measurements provided reliable and accurate positioning even in challenging terrains. GNSS data was processed to create a detailed Digital Terrain Model (DTM), serving as the foundation for the TSF design. The DTM facilitated accurate volumetric analyses, slope design calculations, and the delineation of drainage paths, ensuring that all design parameters met stringent regulatory and operational requirements.