

Managing the construction of Tailing Storage Facility (TSF) under Multiple Contractors – The Role of the Survey Consultant

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SUMMARY

Surveyors play a vital role in the management of the Tailing Storage Facility (TSF), which spans from pre-construction, construction phase, and post-construction to closure and decommissioning. Managing the construction of tailing storage facilities (TSF) under multiple contractors is a daunting and challenging task, and the role of a surveyor is essential in ensuring the safety, compliance, and efficient construction of the facility. Tailings are the leftover materials from the processing of mined ore. They consist of ground rock, unrecoverable and uneconomic metals, chemicals, organic matter, and effluent from the process used to extract the desired products from the ore. Tailings can be in the form of liquid, solid, or a slurry of fine particles. The tailings are therefore filled with substances and chemicals that are not friendly to the environment and its habitat, making it non-negotiable to construct a storage facility that will collect and contain the unwanted substances. A TSF is essential in permit application and information for environmental groups.

In an ideal mine site, the construction phase is handled by the consultant and his choice of a competent contractor to assist in the execution of the facility. The Minerals Commission of Ghana in its quest to enhance and build local capacity in the mining industry aided the decision of mining companies to give preference to locally owned companies to execute contracts on mining engineering services of which TSF is one.

The surveyor's role on TSF is not limited to topographical survey for design purposes but is extended to, construction, oversight monitoring, surveillance, and geospatial data management. Surveyors are responsible for collecting, managing, and updating geospatial data related to the TSF. This data includes topographic surveys, GIS mapping, and geodetic control, which is crucial for long-term management.

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The object of this exercise is to analyze the role the surveyor plays in the geospatial data management of multiple contractors during the construction phase of a TSF, to appreciate the peculiar challenges and the steps taken to overcome them. From the systematic approach, the modality and sequence of data capture, the validation of results, and the presentation to the satisfaction of the stakeholders to uphold the professionalism and ethics of the surveyor.

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1.0 INTRODUCTION

As part of the mining process, the ore is crushed, ground, and/or processed to extract the valuable minerals and metals. The remaining materials are then referred to as tailings, which must be stored or contained within the Tailings Storage Facility (TSF) and managed in a safe and sustainable manner. Tailings are not environmentally friendly, largely due to the chemicals and processes used to extract the minerals, and are required to be contained in these engineered structures (TSFs) which comply with specific design, safety, and environmental control regulatory requirements. TSFs often become a key element in the regulatory process governments employ to ensure the environmental effects are identified and considered before regulatory approval (Contreras, 2022).

In the early days of TSFs constructions in Ghana, foreign companies such as WBHO and PW, led the charge to construct these highly engineering demanding facilities. The companies had teams of geotechnical, geometric and civil engineers who understood the demands and ensured that the constructions were executed to achieve their intended purpose. Government of Ghana in her quest to ensure that Ghanaians benefit from the country's natural resources enacted an L.I through Minerals Commission in 2020, to guarantee that technical and engineering services are offered to companies owned by Ghanaian citizens or to a foreign company who is in collaboration with a company owned by a citizen, licenced to provide such services and

registered to the commission (L.I 2431). This has necessitated the award of projects such as the TSF construction to local companies.

Most of these local companies still lack the resource and technical capacity to handle these demanding projects, informing the decision of clients who are keen to meeting the project timelines to award the construction of demanding projects to multiple local contractors. The lack of resource and technical capacity of some of these contractors puts extra responsibilities on the project consultant in ensuring the smooth progress of the project especially in providing survey services to these contractors. Also, these contractors are not usually given specific task throughout the life of the project and can be swapped to replaced contractors on critical path of the project who do not perform as expected of them to ensure the project progress. The frequent swapping or change of activities create extra quality control and survey responsibilities. This paper seeks to bring to bear some of the challenges that the survey consultant face on the construction of Tailings Storage facilities under multiple local contractors and some of the strategies that can be employed to address the challenges.

2.0 Challenges Faced by Land Survey Consultants

2.1 Absence of Survey Teams Among Contractors

In many cases, the contractors involved in the construction of tailings storage facilities may not have dedicated survey teams or personnel with expertise in land surveying. The construction of these facilities is characterized by demanding surveying requirements, and the absence of in-house survey teams within the contractor's organizations give rise to significant hurdles or challenges for land survey consultants. the lack of survey teams can lead to errors in land measurements, poor survey data quality and inefficiencies in the construction process as a whole. In these situations, the consultant, who must ensure the accuracy of construction activities, will have to provide survey services for the contractors to prevent rework and waste of time. This result in the consultant having to increase survey personnel and equipment to serve the multiple contractors in the construction process.

2.2 Inadequate Coordination Among Multiple Contractors

Another major challenge faced by land survey consultants with multiple contractors in the construction of tailings storage facility is inadequate coordination among the various parties involved. Each contractor may have its own schedule, methodologies and priorities, leading to potential conflicts and inconsistencies with survey data. Inadequate coordination can also result in errors, rework and inefficiencies in implementing the design and impacting the overall project delivery as well as resulting in project delays and cost overruns. Inadequate coordination also leads to poor quality in the collections of survey data and subsequently cause challenges in the reconciliation of quantities for these contractors.

2.3 Varying Survey Methodologies

Multiple contractors usually present varying survey methodologies and construction procedures. Each contractor may utilize different surveying instruments, techniques or software, leading to inconsistencies and inaccuracies in the collected survey data. This can complicate the integration and analysis of survey information, potentially compromising the overall quality of the project. Using varying methodologies and survey instruments also create differences in executing the designs on the ground making it cumbersome for the survey consultant in performing his task.

3.0 Strategies to Address the Challenges

3.1 The Absence of Survey Teams Among Contractors.

In this situation, the Survey Consultant has to provide the survey services to these contractors, the responsibility of explaining drawings and designs to the staff executing the job on the field becomes that of the consultant. The Survey Consultant can establish a clear and comprehensive survey plan that will outline the specific requirements for the constructions of the TSF and detail the responsibilities of each contractor in adhering to the requirements. Additionally surface models and area specific drawings may be created from time to time that further educate the contractors and ensure that accurate measurement and assessment are conducted throughout the construction process. In most instances the Survey Consultant will have to be with the contractor and provide survey services throughout the construction process to ensure that work is done according to design specification. It will also be helpful to provide training and capacity

building programs to contractors to enhance their surveying capabilities from time to time will promote adherence to quality standards on the project. These measures will help bridge the gap created by the absence of survey teams among the contractors.

3.2 Establish Clear Communication Channels

Effective and proactive communication and collaboration among all stakeholders involved in the project are essential for addressing inadequate coordination among multiple contractors. Land survey consultants should establish clear communication channels with all involved parties to ensure that survey methodologies, project timelines, and priorities are aligned. Regular meetings, progress reports, and on-site coordination can help ensure that all the contractors are aligned with survey requirements and are working in harmony to achieve a common goal. Implementing a comprehensive project management plan and document that outlines surveying milestones, deliverables, and responsibilities for each contractor can help ensure that surveying requirements are effectively integrated into the project schedule. Also creating digital collaboration platforms and information management systems can facilitate real-time sharing of survey data and construction progress updates among all stakeholders, promoting transparency and alignment in project execution.

3.3 The Use of Modern Surveying Technologies

The use of modern surveying technologies such as GPS and Drone-base surveying can significantly enhance the efficiency and accuracy of surveying process. By investing in these technologies Survey Consultants can reduced the challenge of multiple contractors without survey teams by providing the necessary survey data and information to all parties involved in the project. Some of these technologies can help reduced the potential for errors and discrepancies in survey data, streamlining the construction process. Drones equipped with high resolution cameras offer a versatile and efficient means of capturing detailed aerial imagery and topographic data. In the TSF construction projects, the drone can be deployed to conduct aerial surveys, monitor earthworks activities and collect survey data that can be used to check construction progress with designs, generate digital elevation models and quantities. This enables real-time monitoring of construction activities, volumetric analysis of earthworks, and

identification of potential safety hazards, all without the need for dedicated survey teams within the contracting companies.

4.0 Conclusion

Local contractors have been prioritised in the awarding of technical and engineering services in Ghana, these companies are still in the journey of building their capacities to meet demanding projects like the construction of TSFs. Survey consultants on the project of constructing TSFs face challenges working with these local contractors. However, these challenges can be addressed through a combination of effective communication, collaboration the use of advanced surveying technology and robust project management techniques. By employing these strategies, consultants can enhance coordination among contractors, and mitigate the gap created by the absence of dedicated survey teams, ultimately contributing to the successful completion of the project. The consultant may invest more in advance survey methodologies and technology to drastically reduce the challenges. By harnessing the capabilities of GPS surveying, drone-based surveying and 3D laser scanning, land survey consultants can overcome the complexities associated with multiple contractors without survey teams. These technologies offer a robust framework for accurate data collection, real-time monitoring, quality assurance, and collaborative information sharing, ultimately contributing to the successful and sustainable construction of tailings storage facilities in Ghana. As the mining industry continues to evolve, the integration of modern survey technologies remains essential for driving innovation and ensuring the integrity of critical infrastructure projects.

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