

An indispensable cog in the
mining value chain

Mining Surveyors

A silhouette of a mining surveyor wearing a hard hat and operating a theodolite mounted on a tripod. The scene is set against a dramatic sunset sky with orange and yellow clouds. A crane arm is visible in the distance on the right side of the frame.

“Mine surveying is a specialist area of surveying that involves all measurements, calculations and mapping, which serve the purpose of ascertaining and documenting information at all stages from prospecting to exploitation and utilising mineral deposits both by surface and underground working”

Surveyors in the mining industry fulfill an essential function since they provide indispensable information to all the other mining disciplines. Mine surveyors are responsible for the acquisition, precise representation and management of data associated with mining operations. They are legally responsible for the preparation and updating of all surface and underground mine plans in purpose to assist various mining disciplines throughout the value chain. Mine surveying functions are generally regulated as indicated in the Statutory Instrument 109 of 1990. The survey standards are normally high and well documented by virtue of the regulation. Mine surveyors are guided by the regulations as their work provides the basis for the planning and control of mine workings to ensure economical and safe mining operations. Survey information is relied upon for the safety of present and future workers within the mine workings as well as the ongoing monitoring of the mine site during and after mining.

Representation

The government, industry and institutions of higher learning get professional representation on mine survey matters from the Association of Mine Surveyors of Zimbabwe (AMSZ). The AMSZ ensures a comprehensive representation of its members in the mine survey discipline. The mandate of the AMSZ includes promotion of the profession, interests of its members and upholding practicing standards. The profession has successfully evolved over the years. However, mine surveyors encounter various issues and challenges within the operating environment. Every mining environment provides its own site specific challenges. But there are a number of challenges that cut across the professional discipline as mine surveyors strive to fulfill their roles.

Quality control and mapping role

Surveyors use various techniques and equipment to gather surveying and mapping data, from the field, which supports the accurate mapping and modeling of the physical world, surface and underground mine workings. Processed survey data is often indicated as co-ordinates that describe features on maps and plans. Some of the data is incorporated as statistics on production tracking and monitoring charts. As is the case with data processing, mapping is normally done electronically, using specialized mapping software. The mapping roles include the updating of statutory maps, plans and sections as required by the regulations.

The roles include the preparation of other legal plans such as locality plans, mining rights plans and servitudes. Other mapping duties such as the preparation of rehabilitation design plans, mine rescue and infrastructure plans are all part of the Mine surveyor's role. Mine surveyors productively contribute to the operations by ensuring quality control in the design and excavation of mine workings. Surveyors play an important role in the need to report material or product along the mining value chain in relation to specific mining processes.

Safety and environmental control function

Mining companies are required by law to put in place systems to ensure safe working conditions. Surveyors are expected to demonstrate competence in promoting and ensuring safety in working areas. Surveying safety roles directly linked to the regulations are measurements required for monitoring:

- Slope stability for waste rock dumps and tailings storage facilities
- Possible land subsidence within the immediate area of the underground operations

Surveyors play an important role in coming up with high-risk and hazard plans. It is important to correlate the surface topography with the underground surveys for the implementation of a safe working environment.

Surveying functions should ensure that no persons are endangered by risks associated with subsidence, collapse of surface buildings and structures resulting from the removal of support, and risks related to mining in the proximity of other underground workings. It is important to note that surveyors are playing a key role in upholding safe working practices in mining operations.

The changing technological landscape

Geospatial data forms the foundation of mining. The rapidly evolving innovations in the geomatics sector are bringing previously unforeseen opportunities that seek to provide a major improvement to the mining industry as a whole. Technology is key to every aspect of an organisation as a means to unlock value and enable quick reactions to business and stakeholder needs. Technology has changed the instrumentation for surveyors much to the exclusion of those practicing in traditional ways. There is more emphasis on data quality, while data processing and management is gaining more ground.

New survey technologies are creating more efficient ways to manage spatially related infrastructure and information. Technology will continue to play an increasing role in the future of the surveying profession. Developments such as airborne scanning, digital photogrammetry and remote sensing enable surveyors to collect more complete data. Mining operations are optimising efficiencies by applying enabling technology. Organisations need to provide products and services that can meet changing customer and competitive conditions.

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Embracing technology minimises handovers and interdependencies that can slow down production cycles. The implementation of digital technologies like the Industrial Internet of Things and automation could transform mining by:

- Changing manual and mechanical processes into digital ones
- Ensuring a safe environment for workers
- Ensuring efficient and productive operations
- Ensuring a sustainable and profitable business

Surveyors are playing a critical role in applying emerging technologies in most mining organisations. However, the educational base must therefore be flexible to deal with this constant change. Learning institutions must ensure that the surveying curriculum keep changing to reflect the current technology and recent developments within the field and allied professions. Graduates must possess skills to adapt to a rapidly changing labour market.

The regulatory framework

The world-over, a mine's operation is normally governed by a significant number of stern and demanding regulatory requirements. These regulatory requirements may vary from one country to another with many requirements directly impacting a host of mine surveying practices and workflows. It is important for a mining operation to maintain and manage the mine survey data in a secure environment throughout the life of the mine. Traditionally, this information has been maintained in hard-copy formats. However, as the industry transitions to digital, mechanisms and solutions that manage and maintain this mixed information environment will need to be established.

Solutions and systems offering opportunities of secure data management capabilities, including an ability to store all survey data, survey reports, plans and more will be required. The regulatory framework should be reviewed to incorporate such changes. Regulations provide for the requirements for diagrams and plans, which must accompany applications for mining rights, permissions, permits and reservations. It is the Mine surveyor's role to ensure that such requirements are fulfilled.