SANCOT News

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South African National Committee on Tunnelling

Advancement in Vertical Tunnelling in Mining

Design and construction of vertical tunnels, more commonly referred to as shaft sinking, continues to rely on particular methodologies that are selected in response to a combination of site requirements, cost models, and available technology. Industry best practice in horizontal tunnelling is well researched and documented; however, changing demands for efficient, quick, and correctly risk-managed shaft sinking projects have revealed the need for similar documented best practice in vertical tunnelling.

Shaft sinking methodologies typically vary between two extremes, on the one side being blind sinking, which is high in cost and labour requirements, yet carries the risk management benefit of being able to timeously respond to adverse geotechnical conditions. At the other extreme, raise boring provides an attractive, rapid, low-cost, and low-risk approach in suitable conditions and is usually preferred over more arduous methods whenever possible.

Strides in technology are being made continuously to enable deeper, larger diameter shafts to be bored as an alternative to conventional shaft sinking. A particular benefit of raise boring is being able to avoid the delays associated with installation of in-line support. However, this very benefit can become its Achilles' heel in a large, deep shaft. Before boring is completed, it might become necessary to treat local breakout at depths exceeding current equipment capacities.

Outcomes of existing geotechnical investigation methods usually indicate that an alternative method to raise boring should be considered when rock mass conditions are expected to be unfavourable. However, it can also usually be assured that poor conditions will occur at some stage within a long shaft. Given the benefits in terms of time, cost, and safety, this has led to risk indicators being questioned and equipment developed to improve risk-management strategies. With tolerance for safety risk practically disappearing, technological innovation continues to be driven ever higher.

The question then presents itself: on what basis is the optimum shaft sinking method selected for a particular project?

Under the umbrella of the ITA (International Tunnelling Association), a workgroup was initiated through SANCOT to put forward a best practice handbook on vertical tunnelling. The handbook is intended to document the process of vertical shaft engineering in order to assist the selection of an appropriate methodology. The complete design process is addressed, including the initial geotechnical evaluation, assessment of shaft design and constructability, pre-sink requirements, and selection of the excavation methodology. Current methods are separated into either conventional or boring, including blind sinking, slipe and line, Alimak raising, blind boring, and boring with a pilot hole. A final chapter addresses the end-stage process for operational readiness.

Good progress was made during the course of 2013. Sub-groups comprising practitioners with substantial experience across the South African mining industry were assigned to gather data and brainstorm methodologies. Following the recent appointment of Ron Tluczek as Chairman, the SANCOT initiative is regaining momentum.

On completion, the handbook is expected to deliver a comprehensive presentation of current best practice, with references to new technological development for efficient, safe, and cost-effective approaches to vertical tunnelling in mining.

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