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Title: Shaft Boring Roadheader – Safe sinking of deep blind shafts

Authors:

Charles Howarth - Managing Director, Herrenknecht Australia, Eagle Farm Qld 4009

Patrick Rennkamp – Product Manager, Herrenknecht AG, Schwanau, 77963 Germany

ABSTRACT

This paper describes the development and application of Herrenknecht's Shaft Boring Road header (SBR) technology from a concept to proven technology used to sink six shafts in Canada, Belarus and the UK. The key drivers of the SBR development are the removal of miners from the shaft floor and the elimination of explosives from the shaft sinking process.

The SBR is designed to sink shafts in soft to medium strength rock. It draws on Herrenknecht's experience in developing tunnel boring machines over the last 40 years. The first four shafts sunk with the SBR in Canada and Belarus were frozen. The fifth and sixth shafts, being sunk in Yorkshire will use cover grouting to control water inflows. The shafts have been lined variously with shotcrete, concrete and steel tubing.

The SRB uses a road header type cutter head on a telescopic boom, which can cut varying diameters within the one shaft. Cuttings from the cutter head are vacuumed up to a loading dock in the stage, loaded into kibbles and hoisted to the surface.

DMC Mining Services completed two 1000 m deep shafts with the SBR for BHP in August 2018 at the Jansen potash mine in Saskatchewan. They purchased two new SBR machines for sinking two 1600 m deep shafts for the Sirius Minerals project in Yorkshire. These shafts commenced sinking in 2019. One attraction for DMC and BHP at Jansen was the system's ability to safely handle heavy components in the shaft.

Deilmann Haniel is sinking two 750 m deep shafts with SBR machines for the Nezhinskiy potash mine in Belarus from the IOO Slavkaliy Minsk company. The shafts have 8 m internal diameters inside concrete lining up to 1 m thick. The lining includes steel tubing in the frozen zone.

The first two SBR machines at Jansen were the prototypes from which a lot was learned. These learnings were applied to the third and fourth SBR machines that Deilmann Haniel is using in Belarus. The learnings from these four shafts have been incorporated into the SBR machines at the Sirius shafts in Yorkshire.

The SBR has proven itself capable of 80 to 90 m/month lined sinking rates in low to medium strength sedimentary rocks for potash mine shaft development. The technology is equally applicable to shaft sinking in Australian sedimentary coal measures strata.