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TUnIS Navigation E-Power Pipe®. Precise Guidance of Small Diameter Tunnelling Machines

The trend towards longer and smaller-diameter projects in Microtunnelling represents an enormous challenge for the guidance system. Pioneering innovations make the use of smaller and smaller machines possible, which do not allow conventional determination of position due to the reduced space availability.
The areas of use for these small-diameter TBMs are various, and the guidance system must likewise be flexible to adapt to the requirements.

An application that needs to be particularly emphasised in this connection is the Herrenknecht E-Power Pipe® method.

The circumstances and demands on exact guidance could not be any more challenging - the machine and the pipeline cannot be accessed by personnel, there is absolutely no visual connection to the TBM, a conventional control survey using known reference points in the shaft area is not possible at any point in time. Despite all this, it is possible for the TBM to tunnel 3D curved advances 1000 m and longer, with the position being determined and represented continuously with an accuracy of less than 10 cm. For this, VMT offers the tailored guidance system, TUnIS Navigation E-Power Pipe®.

The system allows a permanent, precise calculation of the position and displays the current and expected 3D movement direction numerically and graphically. For this, a hybrid system consisting of a fibre-optic gyroscope and an electromagnetic probe are used, which do profitably improve each other in an innovative navigation process that never requires the machine to be idle. This bi-directional support ensures high accuracy at all times so that even the small-diameter machines can always be controlled securely and accurately.

The paper presents the challenges of small-diameter Microtunnelling in terms of guidance and the solution developed for the E-Power Pipe® method.