England: LEICA TCA1700 on ice . . .

Tough times for a LEICA TCA1700 series instrument: measuring boreholes in a man-made ice cavern at a tunnel construction site at Kingston-upon-Hull in north-west England.

Positioned right next to a wall of ice cooled to minus 30 degrees centrigrade at the tunnel portal, the instrument runs day and night at full stretch. With the help of a guidance system and construction laser, every bore is positioned with millimetre accuracy, measured, documented and analysed directly on site.

Tunelling in a freezer

Equipment failure – even at the most extreme temperatures – would be unthinkable, since conventional techniques would be unable to guarantee the precision required for making approximately 170 horizontal bores, each over 20 metres long. The project depends on maximum precision in positioning the chiller unit that protects workers and equipment at the tunnel drilling face. An incorrectly positioned bore drill could puncture the surrounding ice jacket, with fatal consequences: a sudden inrush of water would flood the tunnel, far below sea level.

The LEICA TCA1700 automated total station shows its class even under the most extreme conditions, delivering reliable measurements below sea level at minus 30 degrees Celsius, around the clock.

Millimetric correction

The drilling guide system was developed specially for this project by Beton- und Monierbau GmbH and Geodigital, a Frankfurt-based engineering firm. Each bore involves using the system to perform up to five separate measurement and work procedures, with the help of specially made prism adapters and calibrated attachments. After each measurement, the drilling engineers have immediate access to current estimates of the projected end position, both on a radio remote-controlled operating terminal and graphically on the process computer display. Millimetric corrections keep drilling operations perfectly on course.

By the way: levelling the laser theodolite proved to be the smallest problem. Tripod stands and brackets iced up solid within a very short time.

Gerhard Weithe

The drilling guide system reports deviations right away. All system components intercommunicate by radio.

Prisms are used for regular positional checks.