

Temperature monitoring of ground freezing in the Albula Tunnel II, Switzerland

After more than 100 years of operation of the Albula Tunnel in Switzerland, a condition assessment was carried out. Due to the confirmation of the need of a rehabilitation of the tunnel, it was decided to build the new Albula Tunnel II in 2010. With a length of 110 m, the tunnel passed through Rauwacke. Its solidity decreases from west to east. The biggest problem in the new construction was the 'floating Raibler formation' – a fault zone consisting of silty fine sand. Thus, ground freezing should secure the tunnelling work.

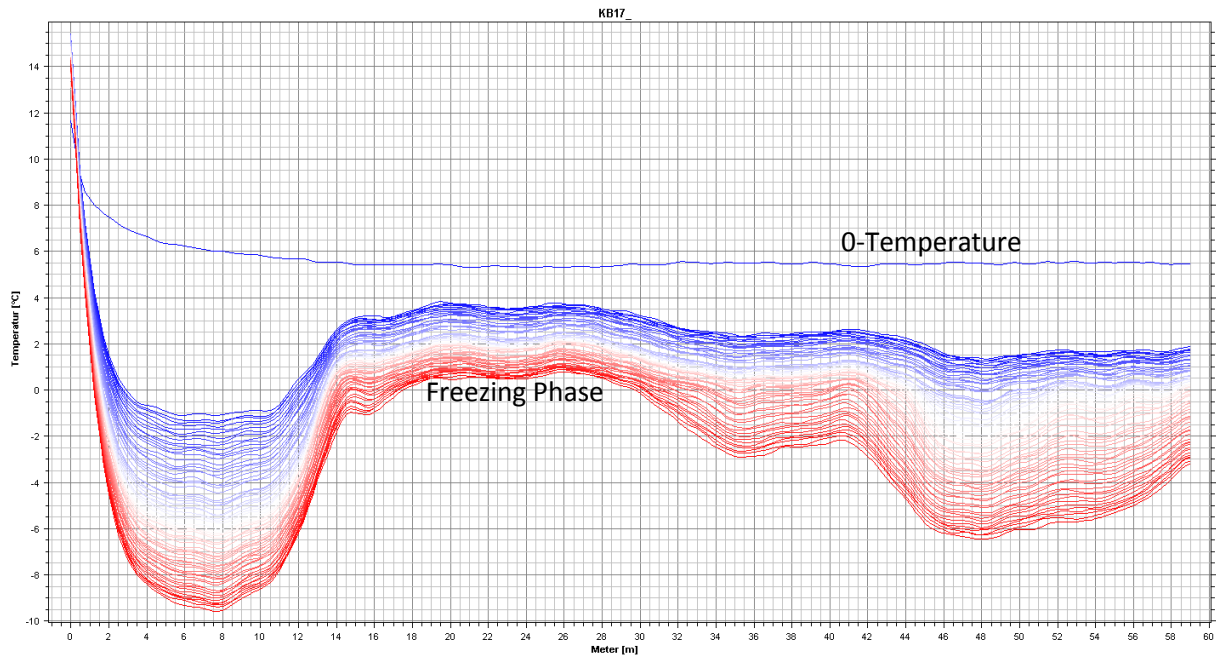


One of the 15 temperature measurement boreholes in the Albula Tunnel II

Artificial freezing of the ground water consolidates the soil and makes it impermeable to water. In order to monitor the frost body, 15 temperature measuring boreholes were drilled and equipped with a fibre-optic temperature monitoring system. Compared to conventional measuring systems, a higher information density is achieved and an exact localisation of temperature changes along the icing lances is given.

The diagram shows the temperature profile of a sounding. Different areas of ground freezing can be identified. Areas with low water content experience faster cooling than areas with higher water content. Thus, the different geological layers could be interpreted.

After a maintenance phase of about five months, the ground freezing was stopped.



Temperature development (from blue to red) within one of the measuring boreholes