"LA MADDALENA" EXPLORATORY ADIT - BASE TUNNEL OF THE TURIN-LYON HIGH SPEED RAIL PROJECT: HYDROGEOLOGICAL MONITORING DATA ANALYSIS

Stefano LO RUSSO [1], Glenda TADDIA [1], Elena CERINO ABDIN [1], Maria Elena PARISI [2]

[1] Department of Environment, Land and Infrastructure Engineering (DIATI), Politecnico di Torino, C.so Duca degli Abruzzi 24-10129 Torino, Italy, glenda.taddia@polito.it
[2] TELT S.a.s.

"La Maddalena" exploratory tunnel, located in the Italy Western Alps (Susa Valley), is one of the four exploratory adits, three in France, completed in 2010, and one in Italy, whose realization is related to Turin-Lyon high-speed rail project.
Concerning tectonical setting ‘‘Pennidic Domain’’is involved in the excavation, and more in details the contact between Piemontese Zone (mainly Calceshits and green stones Unit) and Brianzonese Zone (Ambin Massif Unit and related coverage). However from pk 0+200 m the exploratory adit crosses the Ambin Massif represented by gneiss and micascists. Several monitoring data have been recorded during the excavation, in order to asses geological parameters important for the future Base Tunnel realization. This exploratory adit is now still under completion.
The main aim of this work is to compare the experimental hydrogeological monitoring data with the project hypothesises (Italferr Spa, 2009) in order to check the correctness of inflow forecast in term of discharge, temperature and chemical facies of groundwater. The analysed monitoring data cover the period since the beginning of the excavation of "La Maddalena" exploratory adit to the pk 5+548 m (July 2016). During the excavation phase, the hydrogeological monitoring has then concerned:
• daily measure of the total inflow rate;
• bimonthly measure of conductivity, temperature and pH of each punctual water inflow;
• sampling and chemical analysis of some of the main inflows.
The comparison between expected and measured hydrogeological elements have given important information: water inflow began only after the Ambin Massif Unit was reached by excavation and therefore intercepted water flows were less than expected in design. At ch. 5+548 (27-07-2016) a total inflow of 55.4 l/s is reported. This value is below the minimum stable expected inflow rate. The temperature of inflows varies between 13.7 °C at ch. 0+246 and 39.5 °C at ch. 5+289 (20-22-07-2016). The trend of the total inflow rate analysed considering rainfall patterns registered in four rainfall stations, seems to show a generalised lack of direct correlation with precipitation.
Temperature and chemical composition of punctual water inflow have also given the possibility to find out some characteristics concerning the hydrogeological water supply circuits: i.e. the values of temperature registered along the excavation and the temperature water trend increasing with the excavation, indicate a quite slow hydrogeological circuit interesting the excavation area, even if the water temperature is generally lower than the temperature of the

rock measured over time along the excavation.
La Maddalena exploratory adit experience confirms the importance to realize exploratory tunnels previously the excavation of a main tunnel. Having regard to the rate and temperature of water inflows registered during the excavation, a possible geothermal use of this intercepted water resource could be evaluated more in details.

References

Italferr Spa, 2009. Fase Progettuale della Nuova Linea Torino Lione, Progetto Preliminare 2 (PP2)-Progetto Variante Tecnica – Cunicolo Esplorativo la Maddalena. Relazione geologica e idrogeologica.