Sequential Excavation, NATM and ADECO: What They Have in Common and How They Differ

Fulvio Tonon, Assistant Professor
Department of Civil Engineering, University of Texas at Austin

Host: Prof. J. Taylor

Rabcewicz maintained that “tunnels should be driven full face whenever possible”. ADECO, which stands for “Analysis of Controlled Deformations in tunnels”, now allows us to fulfill Rabcewicz’s dream in any stress-strain condition. In order to achieve that dream and its consequent control over cost and schedule, however, NATM must be abandoned for the ADECO. The presentation traces the history of the sequential excavation, NATM (as first conceived) and ADECO (Analysis of Controlled Deformations) with the aim of shedding light on the unavoidable use of sequential excavation in “soft ground”, and of highlighting advances in tunnel design and construction that have occurred in Europe after and as alternates to the NATM. The presentation covers the basic concepts in the ADECO approach to design, construction and monitoring of tunnels together with some case histories, including: full face excavation for Cassia tunnel (face area > 250 m$^2$) in clays under 5 m cover below an archaeological area in Rome, Italy; Tartaguille tunnel (face area > 150 m$^2$) advanced full face in highly swelling and squeezing ground under 100 m cover where NATM led to catastrophic failure, France; and 80 km of tunnels (face area > 140 m$^2$) advanced full face in highly squeezing/swelling ground under 500 m cover for the high-speed railway line between Bologne and Florence, Italy (turnkey contract).

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