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Computational strategies for predictions of soil-structure interactions during mechanized tunneling

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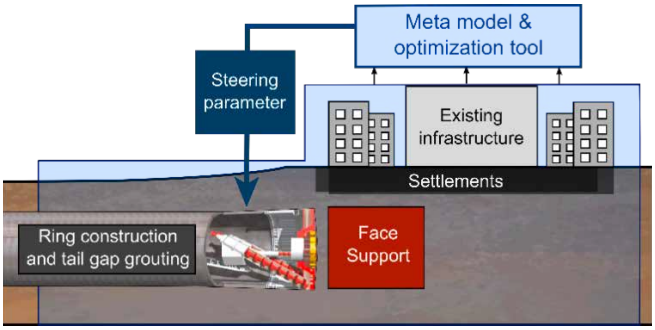

Mechanised tunnelling is a well-established construction technology that allows for tunnel advances in a wide range of geological environments, high ground water pressures or small cover depths as often met in urban tunnelling. During the design and construction of shield-driven tunnels, a reliable prognosis of the tunnelling-induced effects as well as constant process control and real-time countermeasures are required to enable safe construction and to prevent failures. To this end, computational strategies for the holistic prognosis of soil-structure interaction effects caused by mechanized tunneling in the design phase as well as in real time during the tunnel construction are proposed.

In the first part, the components of a process-oriented finite element model for the simulation of the shield tunnelling process in partially saturated soil and soil-structure interaction are presented. Three applications will be discussed: a) The time-dependent effects and interactions induced by the mechanized tunnelling process (consolidation, loading on lining); b) Analyses of interactions between pile foundations and the surrounding soil during tunnel excavation; c) Simulation-based steering of the mechanized tunnelling process in real time during the construction.

In the second part a conceptual model for the parametric modelling and multi-level analysis of soil-structure interaction in mechanised tunnelling will be briefly introduced. Parametric BIM tools, particularly Revit and Dynamo, are employed for the generation of information model on different Levels of Detail (LODs) and used as a basis for structural analysis in tunnelling.