

3D Modelling Aspects of Soft Ground for Tunnelling with TBM

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Abstract

We present the development of an Intelligent Decision Support System (IDSS) for soft soil shield tunnelling. The IDSS development involves a heterogeneous integration of 3D modelling, scientific visualisation, and artificial intelligence technology products for supporting decision-making in tunnelling projects. Modelling and geotechnical characterisation of soil volumes play a critical role in the determination of an applicable Tunnel Boring Machine (TBM) and its performance. The modelling of soil volumes was carried out interactively, using boreholes and Cone Penetration Test (CPT) logs as background information. We have experienced some difficulties in modelling the complex geology of the study area, which is a deltaic setting with discontinuous lenses and inter-fingering layers of sand, clay and peat. In order to overcome these difficulties, some improvements to current three-dimensional geo-information (3D-GIS) techniques are suggested. Geotechnical modelling was based on the site investigation data and the results of laboratory tests on soil samples. Soil property modelling was carried out using knowledge-based approach on rectangular 3D grids. Presently the IDSS prototype allows users to effectively interact with the 3D-GIS, support the analysis and manipulation of geotechnical and mechanical parameters, and provide decision scenario and negotiation routines under varying tunnelling conditions.

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