



PhD Position

Impacts of shallow tunneling in urban areas

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OBJECTIVE: The development of urban planning fosters more and more often underground construction. The excavation of shallow tunnels can lead to significant disturbances or accidental damage on existing buildings (large settlement, development sinkhole, buildings collapse, etc.). New excavation techniques, using pre-reinforcements (face bolting and umbrella arch), are being developed and tested in France with the aim of controlling the surface settlement (Research project NewTun: 2012-2017). Monitoring of excavated tunnel's sections (convergence and face displacement measurements) and surface settlement (geometric survey) can be used to link, throughout the tunnel excavation, the observed surface settlements to the soil characteristics, to the presence of groundwater, together with the efficiency of the reinforcement system..

APPROACH: The proposed work consists in developing a methodology to predict the occurrence of significant potential ground movements during the tunnel excavation. It will be initially based on the statistical data analysis on existing well documented underground structures.

Then in a second stage, it aims to use numerical modeling with appropriate constitutive models for both the soil and pre-reinforcement. The identification and the calibration of the model parameters (both mechanical and hydraulic) will require the use of back analysis algorithm.

The candidate will have to complete, according to the new experimental test results, the existing constitutive laws currently available in The Geosciences Center for soils and pre-reinforcements.

The developed methodology will provide a Decision Aid Tool to tunneling's stakeholders enabling them to select the appropriate excavation methods.

KEYWORDS: Finite Element Method, Soil-structure interaction, Constitutive model, HM coupling, Subsidence.

APPLICATIONS: Underground constructions of 'Grand Paris'.

PREREQUISITE: Candidates should have a good understanding of soil mechanics, hydro-mechanical coupling, statistical concept and numerical analysis. The successful candidate will have to perform numerical simulations using Finite Element Method and be familiar with one or several programming languages (Fortran, Scilab, C,...) is desirable.

REFERENCES :

Hejazi et al, (2008). Impact of constitutive models on the numerical analysis of underground constructions, Acta Geotechnica, 3: 251-258.

Janin J.P et al, (2014). South Toulon tube: 3D numerical back-analysis on in situ measurements, ISSMGE.

[Jahangir E., Monnet A. \(2014\). Preliminary 3D modeling of structural behavior of Face Bolting and Umbrella Arch in Tunnelling. Plaxis Bulletin.](#)

[Jahangir E. \(2011\). Phénomènes d'interaction sol-structure vis-à-vis de l'aléa retrait-gonflement pour l'évaluation de la vulnérabilité des ouvrages. Thèse INPL- LAEGO.](#)

NEWTUN – Nouvelles techniques en tunnels voûtes parapluies, AFTES juillet 2014.