Special issue on building and infrastructure response to ground movement Bridging the gap between geotechnical and structural modelling of SSI

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Editorial

Special issue on building and infrastructure response to ground movement: Bridging the gap between geotechnical and structural modelling of SSI

This special issue of TUST is a follow-up of a Mini-Symposium conceived for the 16th International Conference of the International Association for Computer Methods and Advances in Geomechanics (IACMAG), originally scheduled in July 2020, postponed twice, and finally held at the end of August 2022 in Turin (Italy). The focus of this mini-symposium was on modelling approaches for soil-structure interaction (SSI) problems related to civil infrastructures and building construction.

Foundations and underground linear infrastructure are subjected to soil movements and passive loadings caused by tunnelling and deep excavations in many cases. Consequently, engineers need to predict the resulting SSI that has potentially detrimental effects on both the foundation and the structures above and below ground.

Although in recent years researchers and practitioners have successfully developed fully coupled soil-structure interaction models, geotechnical engineers often rely on empirical rules and decoupled models to predict movements of foundations and subsurface structures, while structural engineers evaluate damage and distortions by performing decoupled analyses of the structures by imposing displacement profile at the soil-structure interface. When fully coupled soil-structure interaction models are recommended by guidelines, no specific indications on the required level of details are provided. Hence, there is a need to better identify the key aspects to be considered for integrated geotechnical and structural interaction models.

The symposium and this special issue both invited contributions discussing viable approaches, with a varying level of complexity, when performing advanced coupled numerical analyses of the soil-foundation-structure interaction rising from ground movements. The aim was to identify key aspects that need to be accounted for in the geotechnical and structural domains to achieve an optimal level of complexity for reliable and still accurate predictions. In particular, to evaluate the impact of accounting for detailed geotechnical and structural aspects on the SSI and the associated risk for losses of serviceability performance, researchers were invited to compare their SSI model results against predictions obtained with current simple routine design approaches (among others, estimations inferred from empirical approaches and/or results obtained from the assumption of fully flexible structures or equivalent linear elastic solids).

The result is a wide scope of topics. Several papers discuss the interaction between tunnelling and masonry constructions, whether real historic buildings (Masini and Rampello, 2021; Miliziano et al., 2022) or idealised cases (Amorosi and Sangirardi, 2021; Burd et al. 2022), framed buildings (Franza et al., 2022; Schoen et al., 2022), metallic arch bridges (Faherty et al. 2022) and jointed pipelines (Klar, 2022). Fewer papers focus on the impact of deep open excavations on existing tunnels (Mu et al., 2022; Zhao et al. 2022) or buildings (Comodromos, 2021). The contributions to this Special Issue confirmed the need for rational planning of the field monitoring of existing structures and geotechnical ground characterisation, as well as for a proper level of sophistication in the material models and numerical schematisations, to make SSI analyses worthwhile. Also, strategies to implement simplified calculation schemes in engineering practice were emphasised.

We hope that you find the papers of interest and value. They can be downloaded from: https://www.sciencedirect.com/journal/tunnelling-and-underground-space-technology/special-issue/10PJP0J3BH7.

Discussion on any aspects of the special issue is very welcome!

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