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Model uncertainty of various settlement estimation methods in shallow tunnels excavation; case study: Qom subway tunnel

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Abstract

In addition to the numerous planning and executive challenges, underground excavation in urban areas is always followed by certain destructive effects especially on the ground surface; ground settlement is the most important of these effects for which estimation there exist different empirical, analytical and numerical methods. Since geotechnical models are associated with considerable model uncertainty, this study characterised the model uncertainty of settlement estimation models through a systematic comparison between model predictions and past performance data derived from instrumentation. To do so, the amount of surface settlement induced by excavation of the Qom subway tunnel was estimated via empirical (Peck), analytical (Loganathan and Poulos) and numerical (FDM) methods; the resulting maximum settlement value of each model were 1.86, 2.02 and 1.52 cm, respectively. The comparison of these predicted amounts with the actual data from instrumentation was employed to specify the uncertainty of each model. The numerical model outcomes, with a relative error of 3.8 %, best matched the reality and the analytical method, with a relative error of 27.8 %, yielded the highest level of model uncertainty.

Keywords: Settlement, Model Uncertainty, Instrumentation, Tunnel Excavation, Qom Subway, Iran.