Title:
Numerical study of the influence of secondary changes in pit depth of excavation stabilized (with a Nailing system) by the method of situ Concrete Piles (Case Study: excavation of Shahrekord twin towers)

Abstract:
In recent years soil nailing has been increasingly used to stabilize slopes and support excavations. This technique has been widely applied due to its low cost, high safety, ease of use and remarkable performance in protection of excavations. Applying a hybrid anchorage method has proven even more effective than simple nailing method. Also, in cases where high safety factor is required anchorage method together with concrete blocks or alternatively anchorage with in situ concrete piles or double profile steel can be used. Thus far a huge amount of research and study on effective parameters affecting safety factors, stress, settlement and displacement have been conducted. However, fewer studies and research, specifically on effect of additional excavation on excavation walls, has been carried out, i.e. there is a paucity of proposed methods and mechanisms to preserve additional depth without compromising the stability of the whole wall while maintaining and controlling the initial slip surface. Therefore, this research presents an investigation on the effect of additional excavation on excavation walls retained by soil nailing system in Shahrekord Twin Towers project with an excavation depth of 23m. Additional excavation depth in this research is 7m and final pit depth will be 30m. In order to retain additional depth, anchorage method with in-situ concrete piles was used. A two-dimensional finite element method (2D-FEM) was conducted. The effectiveness of 2D-FEM is verified via comparison of calculated wall displacement with the field measured value. Based on the FEM result, the importance of seven key design factors, i.e. pile diameter, pile or anchor horizontal spacing, pile embeded length, anchor angle, Pre-stressing force in anchors, anchor bond length, anchor bond length, anchor unbonded length are discussed. The result indicates that FEM analysis is an efficient way to predict the displacement. Finally, a number of design charts are proposed for the anchorage method with in situ concrete piles wall used in additional excavation.

Keywords:
Soil nailing, Settlement, Displacement, Additional excavation depth, Anchorage, Concrete piles