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Deformation Behaviour Analysis Using Finite Element Method during Deep Excavation in Dhaka City

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Extended Abstract

Dhaka, world's most densely populated city is planning to utilize underground space to increase the mobility for city dwellers. However, underground mass rapid transit could be an excellent option to reduce the traffic congestion as well as increase the mobility. Recently, the government of Bangladesh has undertaken a metro rail project in Dhaka with a total length of 128.741 kilometres where out of this total length, 67.569 kilometres will be elevated, while 61.172 kilometres will be underground [1]. These kinds of challenging developments require massive excavations in most of the times in close proximity to pre-existing buildings and underground utilities. The risks associated with subsurface structures can be greatly reduced if the soil behaviours, especially for the soft soils of Dhaka [2], are thoroughly studied prior to excavation.

When planning a deep excavation, finite element analysis is a fantastic tool for studying the behaviour of complex soft soils[3][4]. Traditional shoring methods in such as diaphragm walls and sheet pile walls were used to investigate how the ground behaved at excavation depths ranging from 6.0m to 17.0m.The water level has been considered 5.0m below from the existing ground level during the analysis. For the presence of soft clayey soils to stiff sandy soils, both drained and undrained analysis have been performed. All analyses have been performed in commercial FEM software, Plaxis 2D ,using the MC and HS constitutive models, which allow for a more thorough grasp of the material and more direct comparison of results. The soil SPT data was used to calibrate a number of variables of the models. The shoring systems (e.g diaphragm wall and sheet pile) are modelled using Plate material where the temporary struts are modelled using node to node anchor.

According to the results, analysis of the drained soil shows the greatest possible movement at each excavation depth. The variation of bending moments and ground displacements depends significantly on the type of soil as well as the depth of the excavation. With the increment of embedment depth of the shoring systems, the displacements gets reduced significantly. For adjacent tall structures, diaphragm wall can provide much more stability than other supporting systems.

Keywords: FEM, Plaxis, Surface Deformation, Mohr-coulomb, Hardening Soil, Diaphragm wall, Sheet Pile

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