

Numerical Study Pile Installation Disturbance Zone Effects on Excess Pore Pressure Dissipation

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Abstract : The soil setup is an important factor affecting pile bearing capacity; there are many factors that influence it, all of which are closely related to pile construction disturbances. During pile installation in soil, a significant amount of excess pore pressure is generated, creating disturbance zones around the pile. The dissipation rate of excess pore pressure is an important factor influencing the pile setup. The paper aims to examine how alterations in parameters within disturbance zones affect the dissipation of excess pore pressure. An axisymmetric FE model is used to simulate pile installation in clay, subsequently consolidation using Plaxis 3D. The influence of disturbed zones on setup is verified by comparing parametric studies in uniform and non-uniform fields. Three types of consolidation are employed: consolidation in three directions, vertical consolidation, horizontal consolidation. The results of the parametric study show that the permeability coefficient decreases, soil stiffness decreases, and reference pressure increases in the disturbance zone, resulting in an increase in the dissipation time of excess pore pressure and exhibiting a noticeable threshold phenomenon, which has been commonly overlooked in previous literature. Especially in pile setup research, consolidation is assumed to be horizontal; the study findings suggest that horizontal consolidation has experienced notable alterations as a result of the presence of disturbed zones. A nonlinearity excess pore pressure formula is proposed based on cavity expansion theory, which includes the distribution of soil profile modulus with depth.

Keywords : pile setup, threshold value effect, installation effects, uniform field, non-uniform field

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