A study for basal heave stability on vertical shaft excavation using 3D numerical analysis

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ABSTRACT

Basal heave occurs during vertical shaft excavation in soft soil. When the basal heave occurs, problems such as construction equipment damage and delay in construction period occur due to the elevation of the excavation surface. In this study, three-dimensional numerical analysis was used to simulate the occurrence of basal heave during vertical shaft excavation. The important parameters such as slenderness ratio of vertical shaft, excavation depth, and soil properties were controlled as variables, and the safety factor was calculated according to the changes of each variable. As a result, the effect of each variable on the safety factor was presented, and an equation for the safety factor against the basal heave was proposed.

1. INTRODUCTION

Demand for Underground structures such as utility tunnel and subsea tunnel is increasing due to the dense population and structures in urban area. For the construction of underground structures, the vertical shaft excavation is essential to function as ventilation and path for equipment. The previous studies related to the vertical shaft have mainly carried out analysis about the structural safety of vertical shaft after completion of excavation such as the characteristics of the earth pressure acting on the vertical shaft (Kim et al., 2012a; Shin et al., 2005) and the deformation of the shaft (Shin et al., 2007). However, study about problems that occur during the excavation is relatively minor although the problems pose a risk of lowering the construction workability. Basal heave, one of the problems, is a phenomenon that the excavation surface rises up when the load of surround ground acting on the excavation surface becomes larger as the excavation progresses in deep depth. The previous

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