

Effect of Confinement on the Bearing Capacity and Settlement of Spread Foundations

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Abstract : Allowable-bearing capacity is the competency of soil to safely carries the pressure from the superstructure without experiencing a shear failure with accompanying excessive settlements. Ensuring a safe bearing pressure with respect to failure does not tolerate settlement of the foundation will be within acceptable limits. Therefore, settlement analysis should always be performed since most structures are settlement sensitive. When visualising the movement of a soil wedge in the bearing capacity criterion, both vertically and horizontally, it becomes clear that by confining the soil surrounding the foundation, both the bearing capacity and settlement values improve. In this study, two sizes of spread foundation were considered; (2×4) m and (3×5) m. These represent two real problem case studies of an existing building. The foundations were analysed in terms of dimension as well as position with respect to a confining wall (i.e., sheet piles on both sides). Assuming B is the least foundation dimension, the study comprised the analyses of three distances; (0.1 B), (0.5 B), and (0.75 B) between the sheet piles and foundations alongside three depths of confinement (0.5 B), (1 B), and (1.5 B). Nonlinear three-dimensional finite element analysis (ANSYS) was adopted to perform an analytical investigation on the behaviour of the two foundations contained by the case study. Results showed that confinement of foundations reduced the overall stresses near the foundation by 65% and reduced the vertical displacement by 90%. Moreover, the most effective distance between the confinement wall and the foundation was found to be 0.5 B.

Keywords : bearing capacity, cohesionless soils, soil confinement, soil modelling, spread footings

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