

ABSTRACT

Some structures, including tall buildings, towers, underground reservoirs, and offshore or waterfront structures, are subjected to uplift loads. These loads arise from overturning moments caused by lateral forces such as wave action, wind, and earthquakes. Under these conditions, both tensile and compressive reactions occur on two opposite sides at the foundation level. Therefore, anchors must be designed to resist uplift forces effectively. Plate anchors are utilized in both offshore and onshore structures to counteract such forces.

This study aims to determine the ultimate uplift capacity of model plate anchors measuring $25\text{ mm} \times 25\text{ mm}$, $50\text{ mm} \times 50\text{ mm}$ and $75\text{ mm} \times 75\text{ mm}$ in both reinforced and unreinforced soil bed with embedment ratios of 1, 2, and 3 and anchor inclination angles 30° , 45° , and 60° with vertical under static and cyclic loading. The soil bed has been made of locally available clay and the anchors are of mild steel. The geotextile layer has been placed as reinforcement, at a distance of 0.25 times the embedment depth from the bottom of the anchor and extended up to four times the anchor width. The properties of clay, mild steel and geotextile have been obtained by conducting prior testing appropriately. Numerical analyses have been performed on models of inclined anchors with finite element method using ABAQUS, for both static and cyclic loading. To support the numerical study, a few model anchor tests have been conducted by applying monotonic load with the help of a pulley arrangement, with displacements recorded using a Linear Variable Differential Transformer (LVDT). The experimental results have closely agreed with the numerical ones.

The ultimate pullout capacity under of inclined anchors has been found to increase significantly with the increase in the dimensions of the plate, the embedment ratio, and also the angle of inclination of the anchor with vertical. It has also been found that for inclined anchor that pullout load capacity increases with the application of geotextile in soft clay soil when all other parameters remain same. Finally, a prediction model for ultimate pullout capacity of anchors in unreinforced and reinforced soil has also been proposed by carrying out regression analysis with the help of machine learning on the data obtained from numerical simulations.

Keywords: Inclined anchor, Geotextile reinforcement, Cyclic loading, Reinforced soil bed, Finite element method.