The Role of Soil Anchors in Geotechnical Engineering

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ABSTRACT

The main aim of this paper is to describe of soil anchors such as helical anchor, plate anchor, grouted anchor and pile anchors in soils although the short part is discussed on importance and performance of plate anchors in non-reinforced, reinforced and grid-fixed reinforced (GFR) system in cohesion less soils. GFR is a new tied up system with innovative design, method and material using fiber reinforcement polymer (FRP) which can be tied up the geosynthetics to soils. It is expected from using geosynthetics, grid-fixed reinforced (GFR) to increase the uplift response, cost effective and speed of analysis and design in construction projects.

KEYWORDS: Grid Fixed Reinforced (GFR), FRP, Soil Anchors, Helica, Plate, Grouted, Uplift Response

INTRODUCTION

Many structures experiences overturning moments due to lateral loads which results in a combination of tension and compression responses at foundation level. The design of some structures need to foundation systems to resist uplift forces. In these conditions, an effective and safety design method can achieved through the use of tension elements that these elements are referred to ground
anchors. This element are typically fixed to the structure and embedded in the ground to effective depth so that they can resist uplifting loads. Soil anchors typically used to resist such uplift loads, although they also provided as a measure to increase the soil stabilization. These system used for retaining wall (Figure 1), transmission towers (Figure 2), foundations (Figure 3), sea walls (Figure 4), pipelines (Figure 5). The soil anchors are involved different types such as screw anchors (Figure 6), grout injected anchors (Figure 7), anchor plates (Figure 8), anchor piles (Figure 9), soil hook system (Figure 10).

![Figure 1: using the symmetrical anchor plates in retaining wall](image)

The design of many structures need to foundation systems to resist vertical or horizontal pullout loads. As part of a larger effort to improve the performance of foundation systems, the development of guidelines for anchor system design and installation. The different structures like transmission towers, tunnels, sea walls, buried pipelines; retaining wall and etc are subjected to considerable pullout forces. In such cases, an absorbing and economic design solution may be obtained through the use of tension members. These elements, which are related to as anchors, are generally fixed to the structure and embedded in the ground to effective depth so that they can resist uplifting forces, will safety. The anchors are a thin foundation system designed and constructed specifically to resist any pullout force or overturning moment placed on a structure. Generally, anchors are used to transmit different forces from a structure to the soil. Their strength is obtained through the shear strength and dead weight of the surrounding soil. The different types of anchors used in geotechnical engineering and anchors are including:

- Grout system
- Helical system
These examples would indicate that few soil anchors used to transfer loads from superstructures to denser soils, the presence of lateral loads would induce an uplift reaction on the soil anchors. The design requirement is therefore based on both compressive and tensile criterion for the successful implementation of a structure’s response although tensile criterion is more important compared to compressive criterion in soil anchors. To fulfill these criteria, symmetrical anchor plates are usually employed. They are more effective compared to other soil anchor types. Anchor plates can be casted-in-place by excavation. Construction in cohesion less soil for symmetrical anchor plates is also comparatively easier compared to cohesive soils. With the increasing use of cast-in-place anchor plates to resist uplift forces, the need for a rational design procedures become apparent. This would account for soil properties at the intended anchor plate location and the anchor plate-soil-predicted response.

Figure 2: Transmission towers subjected to uplift forces
Figure 3: Using the anchors in foundations

Figure 4: Using soil anchors in seawall
**Figure 5:** using the soil anchor in pipelines

**Figure 6:** screw anchors
Figure 7: grouted anchors

Figure 8: symmetrical anchor plates
THE PROBLEM OF SOIL ANCHORS

Most of the soil anchoring are involved a grout base in construction projects. The installation can take several days because grout need to special condition in non-reinforced soils in construction. The symmetrical anchor plate can be installed in soils without having to grout it. Most of the ground anchoring system currently proposed results have significant underlying assumptions based on experimental results of the anchoring system in this country that it would appear some general lack and problems. The concern exists for the amount of uplift response and failure zone of symmetrical anchor plates in cohesion less soil. The advantage of using geosynthetics, grid-fixed reinforced (GFR) and numerical analysis methods to investigate anchors behavior can solve some lacks and problems such as uplift response and failure zones in symmetrical anchor plates. Grid-Fixed Reinforced (GFR) is a new tied up system with innovative design, method and material using fiber reinforcement polymer (FRP) which can be tied up the geosynthetics to soils. It is expected from using
geosynthetics, grid-fixed reinforced (GFR) and numerical analysis to increase the uplift response, cost effective and speed of analysis and design in construction projects.

**CONCLUSION**

According to the current review, grouted anchors need to grout in their construction that this is a limitation in zones of cold climates. Although this system need to excavation and their speed is low in construction due to performance of grout. Although plate anchors don’t need to grout but they have much limitation such as need to excavation, low speed in construction and their applicants are few due to uplift forces. The Helical system is a good system for different parts because don’t need grout, excavation and their speed in good in construction but their applicants are limit. It is important that different researchers in the world can extent different anchors with easy condition. In order to extent new anchors, the authors in this paper are testing new anchors and their regards to geotechnical society for decrease of problems in different anchors in near future although using geosynthetics and grid-fixed reinforced (GFR) to investigate anchors behavior is solved some lacks and problems such as uplift response and failure zones in symmetrical anchor plates.

**REFERENCES**


