

Numerical Modelling of Prestressed Geogrid Reinforced Soil System

Authors : Soukat Kumar Das

Abstract : Rapid industrialization and increase in population has resulted in the scarcity of suitable ground conditions. It has driven the need of ground improvement by means of reinforcement with geosynthetics with the minimum possible settlement and with maximum possible safety. Prestressing the geosynthetics offers an economical yet safe method of gaining the goal. Commercially available software PLAXIS 3D has made the analysis of prestressed geosynthetics simpler with much practical simulations of the ground. Attempts have been made so far to analyse the effect of prestressing geosynthetics and the effect of interference of footing on Unreinforced (UR), Geogrid Reinforced (GR) and Prestressed Geogrid Reinforced (PGR) soil on the load bearing capacity and the settlement characteristics of prestressed geogrid reinforced soil using the numerical analysis by using the software PLAXIS 3D. The results of the numerical analysis have been validated and compared with those given in the referred paper. The results have been found to be in very good agreement with those of the actual field values with very small variation. The GR soil has been found to be improve the bearing pressure 240 % whereas the PGR soil improves it by almost 500 % for 1mm settlement. In fact, the PGR soil has enhanced the bearing pressure of the GR soil by almost 200 %. The settlement reduction has also been found to be very significant as for 100 kPa bearing pressure the settlement reduction of the PGR soil has been found to be about 88 % with respect to UR soil and it reduced to up to 67 % with respect to GR soil. The prestressing force has resulted in enhanced reinforcement mechanism, resulting in the increased bearing pressure. The deformation at the geogrid layer has been found to be 13.62 mm for GR soil whereas it decreased down to mere 3.5 mm for PGR soil which certainly ensures the effect of prestressing on the geogrid layer. The parameter Improvement factor or conventionally known as Bearing Capacity Ratio for different settlements and which depicts the improvement of the PGR with respect to UR and GR soil and the improvement of GR soil with respect to UR soil has been found to vary in the range of 1.66-2.40 in the present analysis for GR soil and was found to be vary between 3.58 and 5.12 for PGR soil with respect to UR soil. The effect of prestressing was also observed in case of two interfering square footings. The centre to centre distance between the two footings (SFD) was taken to be B, 1.5B, 2B, 2.5B and 3B where B is the width of the footing. It was found that for UR soil the improvement of the bearing pressure was up to 1.5B after which it remained almost same. But for GR soil the zone of influence rose up to 2B and for PGR it further went up to 2.5B. So the zone of interference for PGR soil has increased by 67% than Unreinforced (UR) soil and almost 25 % with respect to GR soil.

Keywords : bearing, geogrid, prestressed, reinforced

Conference Title : ICCSEE 2016 : International Conference on Civil, Structural and Environmental Engineering

Conference Location : Zurich, Switzerland

Conference Dates : January 12-13, 2016