ABSTRACT:

Problem statement: Tree root water-uptake increases soil strength by increasing the soil matric suction due to pore pressure dissipation in a soil mass, inducing increases in vertical total stress or water extraction, the effective stress to which the soil strata is subjected to may also increase. This causes volume change which might be detrimental to geotechnical structures and shallow foundation. Approach: This study proposed a methodology that can be used for the prediction of the root water-uptake and deformation. It was suggested that negative pore-water pressures can be estimated through two-dimensional governing equation for unsaturated soil and was converted to axi-symmetrical form due radially nature of tree roots. Results: The results of the root water-uptake analysis were then used as input for the prediction of ground displacements in a stress-deformation analysis. A volume change was modeled as a result of matric suction change caused by vegetative induced moisture migration. The proposed method was studied and tested against data collected on a case history involving a mature Lime tree on Boulder clay at Stacey Hall, Wolverton, England and mechanical properties of Boulder Clay. The recommended safe planting distance of trees of height, H, from buildings a distance, L, away is in form of L: H=0.5 m ratio. Conclusion: The predicted results from the two dimensional axi-symmetrical analyses agree well with the measured data in terms of both total vertical displacements and final water contents in the soil. Based on hypothesis, the numerical model developed provides practicing geotechnical engineers an effective tool for designing structures on vadose zones containing vegetation.