EXPERIMENTAL AND NUMERICAL INVESTIGATIONS INTO BASAL REINFORCED EMBANKMENT RESTING ON SOFT SOIL IMPROVED WITH SOIL CEMENT COLUMNS

Sujata Jitendra Fulambarkar (2017CEZ8080)

Abstract

Embankments, which are essential for transportation infrastructure, can face challenges such as settlements and instability when built on weak, compressible soils. Traditional consolidation methods may be economically uncertain and time-consuming, leading to potential damage from significant settlements. In response, Soil cement columns (SCC), with or without basal reinforcement, offer a rapid and cost-effective solution for ground stabilization. The Deep Mixing Method (DMM) involves blending binders with weak geomaterials to create a composite ground with enhanced strength and stiffness, resulting in improved bearing capacity. This enables the rapid construction of embankments while minimizing total and differential settlements, addressing the limitations of conventional consolidation techniques.

The current study involves model testing for various embankment cases, namely, unreinforced (UR), basal geotextile reinforced (BGR), column-supported (CS), and basal-reinforced column-supported (BRCS). These embankments rest on soft clay with different shear strengths and various column installation patterns like Square Group Columns (SGC), Longitudinal Tangent Wall (LTW), Transverse Tangent Wall (TTW), and Tangent Grid (TG) beneath the embankment. Parameters such as settlement at the crest, lateral deformation of the embankment slope, and heaving of the soft soil foundation are thoroughly examined. The Particle Image Velocimetry (PIV) technique is employed to capture soil deformation under the embankment. The findings of the study, presented as displacement contours and deformation profiles, explore the impact of reinforcement, length, number, and installation patterns of the SCC columns. Additionally, a finite element model delves into the effects of various parameters on the performance of BRCS embankments, including soft soil strength parameters, geotextile tensile strength, SCC column characteristics, and geometric parameters. The research provides valuable insights and predictions for the performance of prototype BRCS embankments under vertical loads.