

Shear Strength and Consolidation Behavior of Clayey Soil with Vertical and Radial Drainage

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Abstract : Soft clay deposits having low strength and high compressibility are found all over the world. Preloading with vertical drains is a widely used method for improving such type of soils. The coefficient of consolidation, irrespective of the drainage type, plays an important role in the design of vertical drains and it controls accurate prediction of the rate of consolidation of soil. Also, the increase in shear strength of soil with consolidation is another important factor considered in preloading or staged construction. To our best knowledge no clear guidelines are available to estimate the increase in shear strength for a particular degree of consolidation (U) at various stages during the construction. Various methods are available for finding out the consolidation coefficient. This study mainly focuses on the variation of, consolidation coefficient which was found out using different methods and shear strength with pressure intensity. The variation of shear strength with the degree of consolidation was also studied. The consolidation test was done using two types of highly compressible clays with vertical, radial and a few with combined drainage. The test was carried out at different pressures intensities and for each pressure intensity, once the target degree of consolidation is achieved, vane shear test was done at different locations in the sample, in order to determine the shear strength. The shear strength of clayey soils under the application of vertical stress with vertical and radial drainage with target U value of 70% and 90% was studied. It was found that there is not much variation in c_v or c_r value beyond 80kPa pressure intensity. Correlations were developed between shear strength ratio and consolidation pressure based on laboratory testing under controlled condition. It was observed that the shear strength of sample with target U value of 90% is about 1.4 to 2 times than that of 70% consolidated sample. Settlement analysis was done using Asaoka's and hyperbolic method. The variation of strength with respect to the depth of sample was also studied, using large-scale consolidation test. It was found, based on the present study that the gain in strength is more on the top half of the clay layer, and also the shear strength of the sample ensuring radial drainage is slightly higher than that of the vertical drainage.

Keywords : consolidation coefficient, degree of consolidation, PVDs, shear strength

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