

The effect of cohesive soil depth on consolidation coefficient and Compression index

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Abstract – The settlement is the most serious problem of fine-grained soils and caused by a phenomenon called soil consolidation. Most of previous studies were concerned with studying consolidation conditions depending on the consolidation's theories as Terzaghi's theory. In some cases, a simulation of reality is not given. It was necessary to study the effect of soil depth from ground surface on consolidation parameters to simulate what happens to the cohesive soil in nature. Therefore, the consolidation behavior of four cohesive soils was studied in this paper. The studied soil samples were collected from different depths of cohesive soil layers at four different sites, El-Qalubia governorate, Egypt. A series of laboratory consolidation tests were carried out using Oedometer apparatus. So, the effect of soil sample depths (D) from ground surface on consolidation coefficient (C_v) and compression index (C_c) was investigated. Also, the empirical equations were correlated depending on the relationship between soil sample depths (D) vs. C_v and D vs. C_c .

Keywords – Fine- grained soil, cohesive soil, soil sample depth, consolidation, consolidation coefficient, compression index, settlement,

I. INTRODUCTION

Soil layer consolidation means water out between the soil particles when influence on it by loads or stresses such as: foundations, above constructions and underground constructions loads. The seriousness of soil consolidation appears in the soil layers settlements. This soil layers settlement cause many problems for the foundations and structures [1][2][3][4], especially when there are differential settlements [5][6][7]. Moreover, the tendencies can occur in buildings and constructions since fractures, partial collapses and total collapses can occur in structures, especially in cases of high loads [1][7][8][9].

The researchers have done great efforts to investigate the consolidation parameters of the cohesive soil layers. That is to estimate realistic and appropriate values of the soil layer compressibility and settlement when exposed to stresses resulting from the implementation of foundations and structures. Most applied theories are interested in studying the consolidation parameters of the soil layer to give a simulated representation of the entire layer. It is necessary to study the change in the consolidation parameters at the variable depths of the cohesive layer.

In this research, the changes of consolidation parameters (C_v - C_c) upon increasing the depth of cohesive soil layer are investigated and studied. Laboratory tests are performed to determine the consolidation parameters on natural cohesive samples obtained from cohesive soil layers at different depths.

II. EXPERIMENTAL APPLICATION

For experimental applications, the physical properties (index properties) of the studied cohesive soil samples such as natural water content ($w_{nat.}$), natural unit weight ($\gamma_{nat.}$), liquid limit (LL), plastic limit (PL), shrinkage limit (SL), specific gravity (G_s), free swell (FS), and particle size distribution (sedimentation analysis test) were determined in accordance with Egyptian code (2017). Then, by using Unified Soil Classification System (USCS), a series of consolidation tests were carried out as two-dimensional ones; these tests were performed using odometer apparatus.

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