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Influence of cohesive soil depth on compressibility coefficient and coefficient of volume change

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***Abstract* – The settlement is the most serious problem of fine-grained soils which 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. These studies, in some cases, do not give a simulation of reality representation. It was necessary to study the effect of soil depth from ground surface on consolidation parameters to simulate what happens to the fine soil in nature. Therefore, the consolidation behavior of four cohesive soils was investigated in this paper. The studied soil samples were collected from different depths of cohesive soil layers at four different sites, in 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 compressibility coefficient (av) and volume change coefficient (mv) was checked. Also, the empirical equations were conducted according to the relationship between soil sample depths D vs. av and D vs. mv.**

***Keywords* – Fine-grained soil, cohesive soil, soil sample depth, consolidation, coefficient of compressibility, coefficient of volume change, settlement**

I. INTRODUCTION

Soil layer consolidation means water out between the soil particles when it is influenced by loads or stresses such as: foundations, above constructions and underground constructions loads. The seriousness of soil consolidation appears in the soil layerssettlements. This settlement of soil layers leads to many problems of 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. Where, fractures, partialcollapses and total collapses can occur in structures, especially in cases of high loads[1][7][8][9].

The researchers have exerted 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 it is 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 ofthe entire layer. It is necessary to study the change in the consolidation parameters with the variant depths of the cohesive layer.

In this research, the changes of consolidation parameters (av- mv) with 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 cohesivesoil layers at different depths.

In general, the value of constant A and B for the studied cohesive soil layers at variant sites are about (-0.0009 to 0.0011) and (0.0388 to 0.0412) respectively. So, the empirical equations can be applied as:

$$\Delta m_v = m_v * [- (0.0009 - 0.0011)\, D + (0.0388 - 0.0412)]$$

IV. CONCLUSION

The following conclusions are related to the analysis of consolidation parameters that obtained from experimentally laboratory applied tests of consolidation for studied soils. Accordingly, it can be drawn that

1. The average values of natural soil density (γ_{nat}) at sites for D3 are more than that for D1 and D2 by about 3.65% and 1.48% respectively.
2. The average values of natural water content (w_{nat}) at sites for D3 are less than that for D1 and D2 by about 11.14% and 5.68% respectively.
3. The average values of compressibility coefficients (a_v) for sites at D3 are less than that for D1 and D2 by about 20.29% and 13.72% respectively under each applied stress increment.
4. The relation between compressibility coefficients (a_v) and depth (D) is suggested by the following empirical formula:

$$\Delta a_v = a_v * [-(0.0019 - 0.0025)\, D + (0.072 - 0.0759)]$$

- The average values volume change coefficients (m_v) for sites at D3 are less than that for D1 and D2 by about 17.13% and 12.19% respectively under each applied stress increment.
- The relation between volume change coefficients (m_v) and depth (D) is suggested by the following empirical formula:

$$\Delta m_v = m_v * [- (0.0009 - 0.0011)\, D + (0.0388 - 0.0412)]$$

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