Forecasting of Compression Index*

by

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The author has proposed empirical equations relating compression index, C_C, to plastic limit, W_P, or liquid limit, W_L, and initial void ratio, e_o. Previous empirical relationships proposed by other investigators relate C_C either to liquid limit or the initial void ratio. But it is difficult to believe that equations proposed by the author are better suited or are more reliable than the equations proposed by previous investigators. The writer wishes to make the following comments on the author's approach.

1. Empirical equations proposed by the author are based on consolidation test results on remoulded soil samples. The author recommends the same equations, without modifications, for predicting the consolidation characteristics of undisturbed soil samples. Thus the author in his approach, assumes that consolidation characteristics of remoulded and undisturbed soil samples are identical or structure has no significant influence on compressibility characteristics. Terzaghi and Peck (1967) suggest that C_C for undisturbed soil sample be taken as 1.3 times that for remoulded sample.

2. Examination of Table II in author's paper indicates that values of C_C predicted from the author's equation based on plastic limit, W_P, are generally higher than the values obtained from actual testing of undisturbed soil samples. If it is believed, as per prevailing practice, that C_C for undisturbed soil sample is higher than remoulded soil sample then the author's equation based on tests on remoulded samples should have yielded values generally smaller than those obtained by tests on undisturbed samples. But as noted above the behaviour in the present case is just the opposite. The writer calculated the errors in ths predicted value of C_C for soils in Table II by using author's equations. It may be noted that resulting errors, when equation involving plastic limit is used, vary between —27.0 to +60.0 percent. These errors vary between —27.0 to+133.0 percent when equation involving liquid limit is used. This raises the doubt whether equations proposed by the author are more reliable than those proposed by Skempton, Hough and Nishida (Johnson and Kavanagh, 1968). The Skempton's equation for undisturbed soil sample is

$$C_C = 0.009\ (W_L - 10) \qquad \ldots(4)$$

This equation is found to be quite reliable in predicting C_C for normally consolidated clays of low sensitivity. Unfortunately the author has not given the values for liquid limit or initial void ratio for soils in Table II.

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The writer feels that the author should have given these values and also the values of C_C predicted using equations proposed by Skempton and Hough. Then it would have been possible to find out which of these equations viz. equation proposed by the author or Skempton or Hough is better suited in predicting C_C at least for soils in Table II. Hence the writer requests that the author furnish the data requested above.

3. According to the author himself, the equations proposed by him are applicable to soils with initial void ratio between 0.5 to 1.0. For those soils for which governing criterion in selecting allowable bearing pressure is generally settlement rather than shear resistance initial void ratio is often higher than 1.0. In such cases the author's epuations are not applicable whereas Skempton's equation can be used.

4. The writer suggests the following approach, as a modification to the author's approach, in obtaining empirical equation for C_C which could enable better prediction of consolidation characteristics of undisturbed soil samples.

Based on the author's approach, C_C can in general be expressed as

$$C_C = K_1 e_0 + C \quad \ldots (4)$$

Initially, K_1 may be takkn as 0.21 as in the author's paper,

Then, $C_C = 0.21 e_0 + C$

or $$C = C_C - 0.21\, e_0 \quad \ldots (5)$$

Where C is related to some index property and is expressed as

$$C = K_2 E + K_3 \quad \ldots (6)$$

where E is some index property which may be liquid limit, plastic limit or plasticity index. K_2 and K_3 are constants. Using large number of available tests results on undisturbed soil samples collected from different parts of India it is possible to find out which of the parameters viz. liquid limit, plastic limit or plasticity index can best represent E in Equation 6. Similarly constants K_2 and K_3 can be estimated by regression analysis. For further refinement K_1 can be varied, initially around 0.21, and a value more reasonable than 0.21, if any, can be selected. The writer is currently working to evolve a more generalised approach to obtain empirical equation for prediction of C_C for undisturbed soil samples. The writer believes that his suggested modification to the author's approach would yield more reliable equation for prediction C_C for undisturbed soil samples.

References

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