CHARACTERISATION OF SILICATE-GROUTED SAND ACCORDING TO DYNAMIC PROPERTIES AT LOW STRESS LEVEL

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INTRODUCTION.

Construction of geotechnical structures on the soft ground requires strengthening and stabilization of soil. Although some chemical grouting methods are available such as LW, JSP, SGR and JET, the effect of their implementation is time dependent. This implies that in the presence of applied load for a long time, the deformations are imminent and lead to ground settlement. The reason for such unstable behavior of soil strength is the creep nature of soil material.

METHODOLOGY.

The creep characteristics of silicate-grouted sand were investigated before by numerous researchers [1-5]. However, most of the researches were directed to evaluate its mechanical properties at stress levels that are greater than 40% of the uniaxial compression strength. Kim *et al.* [6] focused on investigation of mechanical properties of soil material at low stress levels, which are less than 20% of the uniaxial compression strength. As such, number of haversine creep tests was conducted at different frequencies (0.01 Hz, 0.05 Hz, and 0.1 Hz) and dynamic properties (complex modulus and phase angle) were determined by application of hysteretic method. From the results of dynamic properties of silicate-grouted sand, it was possible to predict viscoelastic compliance, which was found to agree well with obtained test results.

TEST RESULTS AND CONCLUSIONS.

Overall, it was found that at lower frequencies, the energy dissipation potential of silicate-grouted sandy soil is higher than that of higher frequencies. Due to validity of approximation that viscoelastic nature of the soil material is linear, the stress-strain relationship of results in an elliptical hysteresis loop. It was concluded that the overall time dependent pattern of creep effect was similar to that of the experiments conducted under constant applied load. By analyzing the creep test results at given frequencies, it was found that while there is an increase in the complex modulus, the complex compliance and the phase angle decrease. Also, by knowing dynamic properties of soil material, the power law of the creep compliance can be predicted.

REFERENCES.

1. Ata A., Vipulanandan C. (1999). Factors affecting mechanical and creep properties of silicate-grouted sands. J. Geotech. Geoenviron. Eng., 125(10): 868-876.
2. Christopher B. R., Atmatzidis D. K., Krizzek R. J. (1989). Laboratory testing of chemically grouted sand. Geotech. Test. J., 2(2): 109-118.
3. Clough G. W., Kuck W., Kasali G. (1979). Silicate-stabilized sands. J. Geotech. Engrg. Div., 105(1): 65-82.
4. Kaga M., Yonekura R. (1991). Estimation of strength of silicate grouted sand. Soils Found., 31(3): 43-59.
5. Warner J. (1972). Strength properties of chemically solidified soils. J. Soil Mech. and Found. Div., 98(11): 1163-1185.
6. Kim J. R., Kang H., Kim D., Lee Y., Hwang S. W. (2007). Viscoelastic analysis of constant tests on silicate-grouted sands at low stress levels. J. Geotech. Geoenviron. Eng., 133(9): 1162-1166.