EFFECTS OF UNDRAINED CYCLIC SHEAR AND ATTERBERG'S LIMITS ON THE SECONDARY CONSOLIDATION OF SOFT SOILS

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Abstract: Soft soils of Phu Bai formation continuously spread along the coastal areas from Thua Thien Hue to Quang Tri provinces (central regions of Vietnam). In Hue city and surrounding areas, these soft soil deposits are close to the ground surface and therefore significantly affects the stability of structures and the economic efficiencies of construction. In this study, the silty clay which is partly composing the Phu Bai formation (w_L = 29.4 % and I_p = 10.7) and hereafter called as Hue clay, and Kaolinite clay (w_L = 47.8 % and I_p = 25.5) were used in the unloading-reloading tests and undrained cyclic shear tests with various cyclic shear directions and a wide range of shear strain amplitudes. Then the coefficient of secondary consolidation in the recompression stage following the undrained cyclic shear ($C_{\alpha dyn}$) and also those in the reloading stage of one cycle of unloading-reloading ($C_{\alpha UR}$) were observed and the effects of cyclic shear on the secondary consolidation of clays were discussed based on the ratio of $C_{\alpha dyn}$ to $C_{\alpha UR}$. In conslusion, it is clarified that $C_{\alpha dyn}$ is generally higher than $C_{\alpha UR}$ and that Kaolin with higher Atterberg's limits shows the larger ratio $C_{\alpha dyn}/C_{\alpha UR}$. The effect of cyclic shear direction on the secondary consolidation is evident on Kaolin while negligible on Hue clay with lower Atterberg's limits. The threshold shear strain amplitude, the threshold pore water pressure ratio and the threshold post-cyclic settlement for becoming as $C_{\alpha dyn}/C_{\alpha UR} > 1$ were shown with the plasticity index of clays.

Keywords: Atterberg's limits; cyclic shear; secondary consolidation; soft soil; unloading-reloading.

1. Introduction

Under cyclic loading, clayey soils show more compressible than those under static loading. The differences in the compressibility or settlement between the two loading conditions have been confirmed not only on the primary consolidation but also on the secondary compression (Fujiwara et al., 1987; Moriwaki et al., 2001). As a fundamental problem in soil mechanics, studies on the consolidation of clay under static loads accompanied by calculation methods, have been carried out extensively through both experimental and numerical approaches for a long history (Buisman, 1938; Koppejan, 1948; Taylor and Merchant, 1948; Barden, 1968; Mesri, 1973; Aboshi, 1973; Sekiguchi and Toriihara, 1976; Mesri and Godlewski, 1977; Zeevaert, 1983). The consolidation of clays under cyclic loading has also been studied by various testing models such as cyclic triaxial tests (Yasuhara et al., 1992; Hyde et al., 1993), cyclic simple shear tests (Andersen et al., 1976; Suzuki, 1984; Ohara and Matsuda, 1988;

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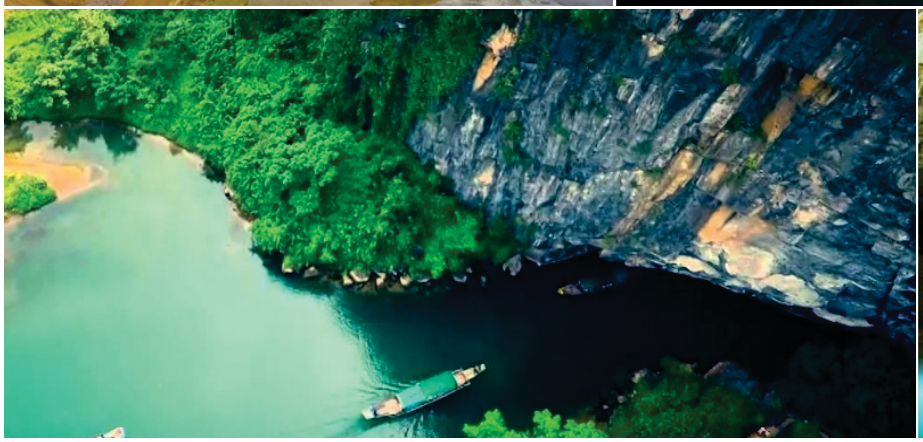
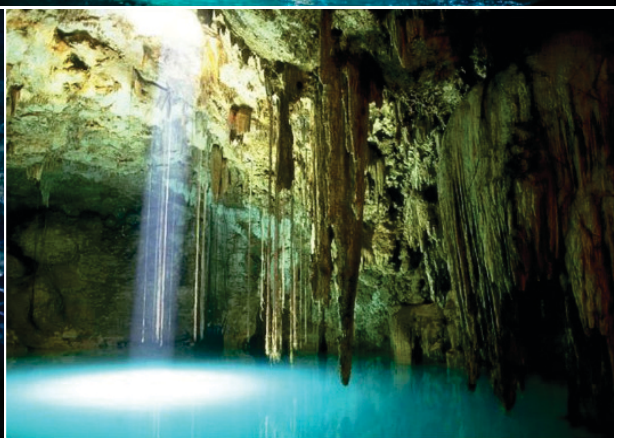

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