

GEOSEMINAR

Particle Dissolution: Effects on k_o

by

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Abstract

The current stress level in the ground has important effects on the deformation and strength characteristics of soils and on the performance of the engineered geosystems. The value of $k_o = \sigma'_h / \sigma'_v$ reflects soil type and formation history. In particular, post-depositional physical and chemical alterations not only affect the mechanical and chemical properties of soils, but may alter the values of k_o as well. The purpose of this study is to explore the evolution of k_o during mineral dissolution using a combination of experimental, analytical and numerical methods. A soft oedometer cell is used to measure k_o . Changes in k_o during dissolution are investigated using mixtures of glass beads and 10% NaCl grains, mixed under a salt-saturated brine to prevent dissolution. Results show a pronounced decrease in the value of k_o , which reaches the k_a failure condition, followed by stress recovery. Discrete element simulation provides particle level insight into the consequences of mineral dissolution: anisotropy in coordination reaches a maximum as k approaches k_a . Furthermore, there is a profound difference in internal fabric between the initial and post-dissolution conditions. The evolution in internal parameters can be used to estimate the mobilized friction angle, which reaches the maximum value near k minimum; this confirms that internal shear failure condition may be reached during dissolution. Mineral dissolution produces a pronounced horizontal stress drop under zero lateral strain boundary conditions and the state of stress may reach the k_a shear failure condition. While horizontal stress recovery often follows upon further dissolution, marked differences in soil fabric are observed between the pre and post-dissolution fabrics. This complex stress history may lead to internal shear planes in diagenetically modified sediments.

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Hosung obtained his B.S in Civil and Environmental engineering at Korea University and M.S in Civil engineering at KAIST in South Korea. He had industrial experiences at Saman Engineering Consultants Co., Ltd. and LG Construction & Engineering Co., Ltd. He is currently a PhD student in Georgia Tech under the supervision of Dr. J.C. Santamarina.