Murthy, Tejas Gorur. S. Ph.D., Purdue University, August, 2006.
Study of the Undrained Static Response of Sandy Soils in the Critical State Framework Major Professors: Monica Prezzi and Rodrigo Salgado

The thesis reports on experimental research on the static undrained response of silty and clayey sands. Triaxial tests were conducted using different specimen reconstitution techniques in order to investigate the effect of fabric on the undrained response of clean sand and sand containing fines. All of the triaxial specimens were isotropically-consolidated before shearing. Four characteristic states were identified in the mechanical response of the soils investigated: the undrained instability state, quasi-steady state, phase-transformation state and critical state.

The experimental data were analyzed in the context of the critical-state framework. The critical state was found to be independent of the initial fabric and of the pre-shear stress history of the sand. It was also concluded that increases in the fines content of the sand rendered the sand more contractive than the original clean sand. The critical-state friction angle remained practically unchanged with the addition of small percentages of silt. The effect of silt on the characteristic states of undrained shear was evaluated and ways to relate the critical state with these states of behavior were proposed.

The plasticity of the fines had an impact on the response of the sand. The variables conventionally used in understanding the behavior of sands with small amounts of fines were evaluated, and the validity of the different variables was assessed. It was found that extension of modeling concepts of clean sands to clayey sands cannot be done directly.

Comparison between triaxial extension and triaxial compression tests conducted on 0 and 5% silty sands showed that the behavior under triaxial extension conditions was more contractive than under triaxial compression for both clean and 5% silty sand.