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Strength Parameters and the Rate Process Theory Applied to Compacted Fadama Soils

Authors : Samuel Akinlabi Ola, Emeka Segun Nnochiri, Stephen Kayode Aderomose, Paul Ayesemhe Edoh

Abstract : Fadama soils of Northern Nigeria are generally a problem soil for highway and geotechnical engineers. There has been no consistent conclusion on the effect of the strain rate on the shear strength of soils, thus necessitating the need to clarify this issue with various types of soil. Consolidated undrained tests with pore pressure measurements were conducted at optimum moisture content and maximum dry density using standard proctor compaction. Back pressures were applied to saturate the soil. The shear strength parameters were determined. Analyzing the results and model studies using the Rate Process Theory, functional relationships between the deviator stress and strain rate were determined and expressed mathematically as deviator stress = β0+ β1 log(strain rate) at each cell pressure where β0 and β1 are constants. Also, functional relationships between the pore pressure coefficient Āf and the time to failure were determined and expressed mathematically as pore pressure coefficient, Āf = ψ0+ψ1log (time to failure) where ψ0 and ψ1 are constants. For cell pressure between 69 – 310 kN/m2 (10 - 45psi) the constants found for Fadama soil in this study are ψ0=0.17 and ψ1=0.18. The study also shows the dependence of the angle of friction (ø') on the rate of strain as it increases from 22o to 25o for an increase in the rate of strain from 0.08%/min to 1.0%/min. Conclusively, the study also shows that within the strain rate utilized in the research, the deviator strength increased with the strain rate while the excess pore water pressure decreased with an increase in the rate of strain.

Keywords : deviator stress, Fadama soils, pore pressure coefficient, rate process
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