# STATIC AND DYNAMIC PROPERTIES OF A NATURALLY CEMENTED SAND

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SYNOPSIS: This paper presents the results of a comprehensive study of the static and dynamic behavior of a naturally cemented silty fine to medium sand which is to be utilized as the foundation material for a nuclear power station in the coastal plain of the eastern United States.

INTRODUCTION: For evaluating the properties of cemented soils, it is necessary to understand the geologic history. This sedimentary deposit, known locally as Vincentown Formation, was a transition from a continental fluvial deposit in the Early Cretaceous to a marine environment and again to continental sedimentation in the Tertiary, resulting in deposition of calcite cement. However, the degree and distribution of calcite cementation within the formation is quite variable.

STATIC PROPERTIES: The cemented soil skeleton influences the strength behavior of the Vincentown sand and makes it strain-dependent. The cemented soil skeleton initially compresses under a load as would be expected, but with further straining it tends to dilate (as would a dense material) as demonstrated by the pore pressure response and the stress path plots. At axial strains below one to two percent, the cohesion caused by the calcite cement bonding between particles is the major component of strength. The cohesive shear strength is destroyed around one percent strain and at the same time the frictional strength becomes predominent. High confining stress was also found to destroy the cementation. The cohesive shear strength is variable since the natural deposits have variable degrees of cement solution. No correlation between effective angle of internal friction and porosity could be made as usually is the case in uncemented sands.

DYNAMIC PROPERTIES: Correlation of index property test data with the cyclic triaxial test data demonstrated that the cyclic strength of the Vincentown sands cannot be correlated to changes in index properties as is usually expected in uncemented sands. In other words, the cyclic strength is statiscally the same at all densities and content of fines. However, the observed cyclic strength in test samples was variable due to the variable magnitude of cementation and bonding between the particles of undisturbed samples. When the same material is tested by reconstituting the samples at the same dry density as the undisturbed samples, the dynamic shear strength was significantly smaller and relatively uniform in character. The reduction in shear strength of the remolded samples and their relative uniformity in strength, demonstrate the distinction of cementation which exists in the natural condition. The dynamic behavior of the least cemented samples of Vincentown Sands in their natural condition was found similar to uncemented sands with relative densities above 70%. It may be pointed out that due to very high fine contents, the determination of Relative Density by standard tests is not possible and relative density, therefore, is not a significant index property for calcite-cemented sands.

The effects of cementation are not always readily apparent to touch; however, petrographic studies indicate that, while concentration can vary on a small scale, it also varies on a larger scale over the entire stratigraphic interval of the Vincentown Formation.

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