Geotechnical Engineering Seminar
Friday, February 1, 2008
Mason 142A, 12:00-1:00pm

**Non-linear dynamic macroelements for performance-based optimization of liquefaction mitigation strategies: Soil-structure interaction analyses of waterfront structures**

**by Varun, MS**

**ABSTRACT:**
The seismic response of pile-supported wharfs is inherently a complex soil-structure interaction problem that involving ground shaking, large ground displacements due to liquefaction of the fill, coupled transverse, longitudinal, and torsional response of the wharf, and the response of above-ground structures. As part of an integrated approach opting to develop geotechnical and structural mitigation strategies for improving the seismic performance of port facilities, the proposed research involves the development and implementation of simplified nonlinear Winkler-type mechanical models via finite element simulations for the analysis of the seismic response of pile-supported wharves. Natural and treated soil profiles against liquefaction will be investigated and generic elements will be developed for each group, calibrated via numerical simulations and validated via small- and large-scale experimental data. The macroelements will account for the multitude of soil resistance mechanisms mobilized at the foundation of pile supported structures by considering both material and soil-pile interface (geometric) nonlinearities during dynamic loading of single piles. The implementation of these models will then be extended for the response prediction of 3D pile-supported waterfront structures subjected to vertically propagating seismic waves. The overarching goal of the proposed research within the context of a collaborative effort supported by NEES is to reduce the computational effort associated with statistically sound risk assessment studies of port systems, which are based on a large number of alternative hazard, geotechnical and structural configuration scenarios. Based on physical principles, field, centrifuge and laboratory experimental data and numerical parametric studies, results of the proposed research will be applicable for the analysis of seismic soil-structure interaction problems of pile-supported structures in liquefaction susceptible site conditions not limited to waterfront configurations of port systems.

**BIO:**
Varun received his MS in CE from Georgia Tech in Dec 2006 and his B.Tech in CE from Indian Institute of Technology Delhi (New Delhi, India) in May 2005. He has worked as a Junior Research Fellow in the Department of Civil and Environmental Engineering at IITD for two months after receiving his B.Tech. He also worked as an intern in Delhi Metro Railway Corporation and Larsen & Toubro, ECC. He is a student member of the ASCE, EERI and NEES. He is currently pursuing his Ph.D degree in the area of numerical methods in earthquake engineering and soil-structure interaction.