

Numerical Simulation of Seismic Liquefaction for Treasure Island Site



Hua Lu[✉], Ziyun Lin, Xudong Zhan, Yanxin Yang[✉], and Di Wu

Abstract By conducting numerical simulations of Treasure Island site in 1989 Loma Prieta earthquake, the Hilbert-Huang transform was used to study soil liquefaction. The UBC3D-PLM constitutive model was used to simulate the dynamic behavior of sand, the non-liquefied soil was simulated by Hardening Small Strain model, and the seismic information recorded in the PEER database was used for deconvolution analysis by one-dimensional equivalent linear analysis method, and the within motion was applied. Rayleigh damping is used in the numerical simulation process, and the damping ratio is 5%. Based on the Hilbert-Huang transform analysis, it is concluded that the UBC3D-PLM constitutive model can effectively simulate the dynamic behavior of soil. The amplification of the peak acceleration was from the bottom of Sandy fill to the ground surface, and the low-frequency content was shifted due to liquefaction in the process of transmission to the surface, and the high-frequency content was identified at the surface.

Keywords Liquefaction · Dynamic analysis · UBC3D-PLM · Hilbert-Huang transform

1 Introduction

Liquefaction induced by earthquake is one of the important research topics in geotechnical earthquake engineering. During liquefaction of sand or sandy soil, the pore water pressure of saturated sand increases rapidly under dynamic loads, resulting in a decrease in the effective stress. When the effective stress approaches to zero, the soil bearing capacity reduces and the soil will liquefy and behave like liquid.

Liquefaction will cause severe damages to structures and foundations. For example, in 1995 Kobe earthquake [1], the soil liquefied due to the seismic motions,

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Tilt The Treasure Island Liquefaction Test Structural Systems Research Project

Osman Amr El Menchawi



Tilt The Treasure Island Liquefaction Test Structural Systems Research Project:

TILT Scott A. Ashford, Kyle M. Rollins, 1999 This report presents the results of the Treasure Island Liquefaction Test TILT a joint project carried out by the University of California San Diego and Brigham Young University To improve our understanding of the lateral load behavior of deep foundations in liquefied soil a series of full scale lateral load tests were performed at the National Geotechnical Experimentation Site NGES at Treasure Island in San Francisco California The ultimate goal of the TILT project was to develop lateral load displacement relationships for a variety of individual piles and pile groups in liquefied sand under full scale conditions The tests were carried out using a high speed hydraulic loading system after the sand surrounding the piles was liquefied using blasting techniques This report presents backcalculated p y curves for single pipe piles pile groups and cast in steel shell piles before and during liquefaction as well as through dissipation of excess pore water pressures In addition recommendations with regard to design of deep foundations in liquefied soil are presented

Development of Generalized Pseudostatic P-y Curves for Liquefied Sands Osman Amr El Menchawi, 2006

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Technical Report , 2003 **Transportation Research Record** , 2000 **Centrifuge Modeling of Permeability and Pinning Reinforcement Effects on Pile Response to Lateral Spreading** Lenart Luis Gonzalez Lagos, Tarek H. Abdoun, Ricardo Dobry, 2007

Risk and Variability in Geotechnical Engineering Michael A. Hicks, 2007 This book presents cutting edge techniques for characterising quantifying and modelling geomaterial variability in addition to methods for quantifying the influence of this variability on the performance of geotechnical structures It includes state of the art refereed journal papers by leading international researchers along with written and informal discussions on a selection of key submissions that were presented at a Symposium at the Institution of Civil Engineers on 9th May 2005

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