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Seismic Response of Deep Foundations Subjected to Liquefaction-Induced Lateral Spreading: Integrated Research and Practical Implications

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Fifth International Conference on

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and Symposium in Honor of Professor I.M. Idriss

May 24-29, 2010 • San Diego, California

SEISMIC RESPONSE OF DEEP FOUNDATIONS SUBJECTED TO LIQUEFACTION-INDUCED LATERAL SPREADING: INTEGRATED RESEARCH AND PRACTICAL IMPLICATIONS

Paper No. SOAP 3

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ABSTRACT

Integrated research is described on the response of pile foundations subjected to lateral ground deformations associated with sand liquefaction. Field evidence, experiments and analysis have indicated that pile bending and other response aspects depend on a complex manner on – and are very sensitive to - several parameters including the specific foundation and structural system, the free field ground deformation, and soil aspects such as layering and properties of nonliquefied and liquefied soil strata. The research presented focuses on sites where the liquefiable soil reaches the ground surface (especially important to bridge foundations), showing that in this case the permeability and stiffness of the soil play a major role on pile response to ground deformation. Full-scale and centrifuge experiments with advanced instrumentation as well as Finite Element and Discrete Element numerical simulations, are described and integrated to show the main phenomena affecting soil and pile response. Possible implications are discussed for the analysis, design and retrofitting of deep foundations against lateral spreading.

Key Words: liquefaction, lateral spreading, pile response, full-scale experiments, centrifuge tests, advanced instrumentation, Finite Elements, Discrete Elements