

Large-scale Centrifuge Modeling in Geotechnical Research

Ross W. Boulanger^{1*}, Daniel W. Wilson², Bruce L. Kutter³, Jason T. DeJong⁴, and Colleen E. Bronner⁵

¹Professor, Department of Civil and Environmental Engineering, University of California, Davis, CA, USA, rwboulanger@ucdavis.edu

²Associate Director, Center for Geotechnical Modeling, Department of Civil and Environmental Engineering, University of California, Davis, CA, USA, dxwilson@ucdavis.edu

¹Professor Emeritus, Department of Civil and Environmental Engineering, University of California, Davis, CA, USA, blkutter@ucdavis.edu

¹Professor, Department of Civil and Environmental Engineering, University of California, Davis, CA, USA, jdejong@ucdavis.edu

¹Associate Professor of Teaching, Department of Civil and Environmental Engineering, University of California, Davis, CA, USA, cebronner@ucdavis.edu

* Corresponding author

Abstract

The 9-m radius geotechnical centrifuge at the Natural Hazards Engineering Research Infrastructure (NHERI) facility at the University of California at Davis provides unique and versatile modeling capabilities for advancing methods to predict and improve the performance of soil and soil-structure systems affected by earthquake, wave, wind and storm surge loadings. The development of this and other large-scale geotechnical centrifuge modeling facilities over the past thirty years has enabled major advances in geotechnical engineering and opened new opportunities for further advances in the coming decades. Large-scale centrifuge models are particularly effective for the building of basic science knowledge, the validation of advanced computational models from the component to holistic system level, and the validation of innovative mitigation strategies. The capabilities and unique roles of large-scale centrifuge modeling are illustrated using three example research projects. Broader impacts are described including those stemming from operations activities, the coordination of activities by the center's user base, and the mentoring and technical training of researchers. Future directions and opportunities for research using the NHERI facilities are discussed.