

EXPERIMENTAL GEOMECHANICS FOR EARTHQUAKE RESILIENCE AND SUSTAINABLE INFRASTRUCTURE

Speaker

Prof. Welson Kwan

California State University, Los Angeles

Abstract

Geotechnical engineers face growing challenges associated with seismic hazards, climate change, urbanization, and emerging environmental contaminants. Addressing these challenges requires a deeper understanding of soil behavior under complex loading and environmental conditions. This presentation summarizes recent experimental research conducted at California State University, Los Angeles, aimed at advancing both earthquake resilience and sustainability in geotechnical engineering. The first part of the presentation focuses on laboratory investigations of soil liquefaction and post-liquefaction behavior using advanced cyclic and bi-directional simple shear testing systems. Results demonstrate how loading direction, stress path complexity, particle characteristics, and drainage conditions influence liquefaction resistance and post-earthquake performance. These findings provide new insights for improving the evaluation and design of infrastructure in seismic regions. The second part highlights emerging research on sustainable geotechnics, including the effects of microplastic contamination on soil behavior, the characterization of recycled and industrial byproduct materials, and the integration of geophysical techniques for non-destructive soil assessment. Experimental observations reveal important interactions between environmental contaminants and geomechanical properties, with implications for long-term infrastructure performance and environmental stewardship. The presentation concludes by discussing opportunities for integrating advanced laboratory testing and sustainable engineering practices to enhance infrastructure resilience. The work illustrates how experimental geotechnics can contribute to safer, more sustainable, and more adaptable civil infrastructure systems in both earthquake-prone and rapidly urbanizing regions.

Biography

Prof. Welson Kwan is a Professor and Interim Chair of the Department of Civil Engineering at California State University, Los Angeles (Cal State LA). He received his Ph.D. in Geotechnical Engineering from The University of Texas at Austin and both his M.S. and B.S. degrees in Civil Engineering from the University of California, Berkeley. Dr. Kwan's research focuses on geotechnical earthquake engineering, soil liquefaction, advanced laboratory testing, geophysical characterization of soils, and sustainable geotechnical materials. He is recognized for his contributions to cyclic and bi-directional simple shear testing, particularly in advancing the understanding of soil behavior under complex earthquake loading conditions and post-liquefaction response. His recent research has expanded to include the effects of microplastic contamination on soil behavior, sustainable reuse of industrial byproducts, and the development of innovative laboratory and geophysical techniques for resilient infrastructure systems. Dr. Kwan serves as Faculty Advisor to the Cal State LA Student Chapter of the American Society of Civil Engineers (ASCE). He was recently honored with the 2026 Outstanding Faculty Advisor Award from the ASCE Metropolitan Los Angeles Branch.



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