NEW ZEALAND GEOTECHNICAL SOCIETY INC

A Collaborating Technical Society of The Institution of Professional Engineers New Zealand

Christchurch Branch Presentation
Wednesday 12th November 2025
University of Canterbury,
Ernest Rutherford Room 140
Refreshments 5.30pm - Presentation 6.00pm

Comparison of *In-Situ* and Laboratory Test-based Soil Liquefaction and Cyclic Softening Responses

Presented by Armin W. Stuedlein, PhD, P.E., F.ASCE

This Presentation describes a series of dynamic, *in-situ* tests conducted within natural soil deposits to deduce their seismic and post-seismic responses and presents side-by-side comparison to the results of cyclic and post-cyclic laboratory test programs and/or laboratory test-based models to establish the similarities and differences between the two techniques. The deposits investigated included a low plasticity silt deposit at mean depth of 2.5 m, a moderate to high plasticity silt deposit at a depth of approximately 10 m, and a medium dense sand deposit at a depth of about 25 m. Two methods for applying seismic loading *in-situ* were deployed: vibroseis shaking and controlled blasting. In-shaking responses considered include relationships between direct simple shear- (DSS-) equivalent shear strain and maximum and residual excess pore pressure, and cyclic resistance. Post-shaking responses are compared in terms of settlements and volumetric strains to general and site-specific post-cyclic volumetric strain models for the medium dense sand and medium to high plasticity silt deposits, respectively. The post-shaking monotonic undrained shear strength of the medium to high plasticity silt deposit is compared to a site-specific post-cyclic strength model. Key issues surrounding the differences between laboratory and *in-situ* testing are identified and highlight relevant factors contributing to observed similarities and differences in the observations, including use of reconstituted specimens, and the effects of multidirectional shaking, partial drainage, and excess pore pressure redistribution – effects which are difficult to simulate in the laboratory.

Dr. Armin W. Stuedlein is a licensed professional engineer and Professor of Geotechnical Engineering in the School of Civil and Construction Engineering at Oregon State University. Armin received his MS and PhD in geotechnical engineering from Syracuse University (2003) and the University of Washington (2008), respectively. He joined the faculty at OSU in 2009 after consulting for Seattle-based firms, where he specialized in port and harbor engineering with an emphasis on foundation and earthquake engineering. The results of his research have been disseminated through 175+ publications and consultation for PacNW firms and focuses on liquefaction and cyclic softening through dynamic *in-situ* and cyclic laboratory testing, ground improvement, experimental and numerical investigations of soil-structure interaction, and probabilistic geotechnical analyses. His research is funded by various departments of transportation, the National Science Foundation, and industry partners. He is the Chair of the Soil Improvement Committee (ASCE G-I), outgoing Editor at the ASCE Journal of Geotechnical and Geoenvironmental Engineering, Editor at the Journal of the Deep Foundations Institute, and Editorial Board member for Georisk and the Canadian Geotechnical Journal. Professor Stuedlein received several awards, most recently the 2023 ASCE J. James R. Croes Medal and the 2023 and 2024 Fredlund Awards.