

Geotechnical Frontiers 2025

Soil Characterization and Improvement

Selected Papers from Sessions of Geotechnical Frontiers 2025

Geotechnical Special Publication Number 368

Louisville, Kentucky, USA

2-5 March 2025

Editors:

Melissa S. Beauregard
Aaron S. Budge

ISBN: 979-8-3313-1522-1

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2025) by American Society of Civil Engineers
All rights reserved.

Printed with permission by Curran Associates, Inc. (2025)

For permission requests, please contact American Society of Civil Engineers
at the address below.

American Society of Civil Engineers
1801 Alexander Bell Drive
Reston, VA 20191
USA

Phone: (800) 548-2723
Fax: (703) 295-6333

www.asce.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

Contents

Engineering Geology and Site Characterization

Difference of Hammer Hanging Mechanisms on Standard Penetration Test Energy Transfer Ratio	1
Tyler Southam, Shahrooz Rashidi, and Nick Ekman	
Soil Moisture Estimates from Remote Sensing, In Situ Testing, and Laboratory Testing at an Active Landslide.....	12
Treves Li, Parker Blunts, Drew Gomberg, and Dimitrios Zekkos	
Piezocene Screening Approach for Regular, Organic, and Sensitive Soft Clays.....	22
Paul W. Mayne, Ethan Cargill, and Jim Greig	
Hybrid Machine Learning for Enhanced CPT Sounding Predictions at Unsampled Locations.....	38
Laith Sadik, Sara Khoshnevisan, and Lei Wang	
Development of a Soil-Specific Calibration Model to Estimate Moisture Content Using Multi-Gene Genetic Programming for a Hybrid Nuclear-Electric Density Gauge	47
William J. Baker III and Christopher L. Meehan	
Simulation of CPT Points and Empirical Settlement Using Simulated CPT Points with Kronecker-Product Gaussian Process Regression Approach	57
Anthony Mack, Seok Hyeon Chai, Sina Javankhoshdel, Thamer Yacoub, and Jianye Ching	
Modeling Spatial Variability of Ground-Motion Site Resonances for the Jackson Purchase Region in the New Madrid Seismic Zone	65
Yichuan Zhu, N. Seth Carpenter, Alex C. Miller, Hui Wang, and Zhenming Wang	
Relating Beach Groundwater-Surface Water Dynamics to In Situ Strength from Dynamic Penetrometers	75
Nina Stark, Stephen Adusei, Jonathan Hubler, Mohamad El Ahmad, Thomas Mayer, Tian-Jian Hsu, and Jiaye Zhang	
Unit Weights of Glacial Soils by CPTu	83
Cassandra L. Champagne, Erron J. Peuse, Roman D. Hryciw, and F. Estéfan T. Garcia	
Assessing Geotechnical Variability in Geological Formations: Insights from In Situ CPT Data Analysis in Illinois	92
Jiangting Liu, Scott M. Olson, Jason F. Thomason, and Andrew C. Anderson	

Geophysical Engineering

- Soil Suction Dynamics in Vegetated Soil: From Deterministic to Probabilistic Analysis with Electrical Resistivity.....103**
Md. Jobair Bin Alam, Asif Ahmed, and Naima Rahman

- Assessing the Effects of Receiver Configuration on Sinkhole Characterization Using Full Waveform Inversion: A Comparative Numerical Study.....113**
Pourya Alidoust and Joseph T. Coe

- Investigating Seepage through Earthen Dams Using Electrical Resistivity Tomography: Case Studies from Hindsville Lake Dam and Elmdale Lake Dam, Arkansas123**
Mohammadyar Rahimi, Clinton M. Wood, and Kevin M. Befus

- Determination of In Situ Rock Density and Elastic Moduli with SH-Love Wave Tomography138**
Khiem T. Tran, Ruoyu Chen, and Michael McVay

- Enhancing Geotechnical Monitoring and Asset Management through IoT-Enabled Sensor Integration.....147**
A. Q. M. Zohuruzzaman, Mahdi Zulfikar, Sadik Khan, Thomas Beasley, and Abby Cisko

Rock Mechanics

- Experimental Study of the Impact of Porosity on Bio-Induced Cementation in Clay-Rich and Dolomite-Rich Rocks Using MICP.....155**
Mary C. Ngoma and Oladoyin Kolawole

- Assessing Rock Slope Stability under Dynamic Loading: A Case Study of North Sikkim, India163**
Amalesh Jana, Mithresh K. Pushpan, Arindam Dey, and S. Sreedee

- Characterization of Shale Mechanical Properties via Nanoindentation Scratch Test174**
Fereshteh Rahmani and Wilson F. Espinoza

Soil Improvement

- Innovative Vibro-Replacement Technique for the Foundation of a 22-Story Tower in West Palm Beach: A Case Study in Cost-Effective Design and Sustainability.....186**
Cyrus Jedari, Dustin Walkenhorst, and Matthew E. Meyer

Analytical Solutions for Radial Large-Strain Consolidation Considering Time-Dependent Discharge Capacity.....	197
Khrawboklang Kharsyiemong, Vishwas A. Sawant, and Satyendra Mittal	
Effects of Water Absorption Capacity of Organic-Inorganic Hybrid Modifiers for the Treatment of Surplus Soil	207
Alula Kassa and Kimitoshi Hayano	
Monotonic Behavior of Improved Soft Sediment under Direct Simple Shear Loading	218
Mahdi Talebi, Tyler J. Oathes, Robert Miskewitz, Kaleb M. Arnold, and Eva Pharande	
Effects of Curing Environment and Temperature on Properties of Cement-Stabilized Soil with Coal-Derived Char	228
Hua Yu, Priyanka Joshi, Chooikim Lau, and Kam Ng	
Advanced Instrumented Plate to Study the Effect of Biopolymers on Soil Cracking upon Drying	237
Leela Krishna Mohan, Zachary Nick, Samantha Lucke, Lucas Walshire, and Marcelo Sanchez	
Enhancement in the Water-Holding Capacity of Soils in the Central High Plains through Biochar Amendment	247
Anup Lamichhane and Seunghee Kim	
Enhancing Sandy Soil Erosion Resistance with Biopolymer Treatments	258
Anish Lamsal, Mohammadhasan Sasar, and Sherif L. Abdelaziz	
Polyurethane Grouting for Foundation Reuse at the Kentucky International Convention Center	266
Randy Post and Aaron Rogers	
Laboratory Durability Evaluation of Sandy Soil Stabilized with Synthetic Polymer	277
Prince Kumar, Anand J. Puppala, Surya Sarat Chandra Congress, and Jeb S. Tingle	
An Experimental Investigation on the Effect of CO₂ Curing on the Strength Response of Pozzolanic Based Alkali-Activated Binder Treated Expansive Soils	287
Mazhar Syed, Yassir Mustafa, and Mohammed Al-Osta	
Groutability Assessment of Liquid Polymer in High Fine Content Soils	296
Jie Huang, Alejandro Schorsch, Drew Johnson, Jinhu Song, Fei Wang, and Julian Sanchez	

Stabilization of Expansive Soil Using a Hydrophobic Chemical Stabilizing Agent	306
Suman Shrestha, Mehran Azizian, Gang Lei, and Xinbao Yu	
Benefits of Incorporating Calcium in Biopolymer-Stabilized Expansive Soil	316
Avishek Ghosh, Rabindra Bohara, and Aritra Banerjee	
Flexural Behavior of Rigid Inclusions and Implications for Seismic Performance	326
James R. Gingery and Francisco Humire	
Hydraulic Conductivity of a Sand Cemented with Enzyme-Induced Carbonate Precipitation	337
Noah A. Madrigal, Emilia Marmolejo, and Paola Bandini	
Micro-Mechanical Analyses to Understand the Durability of Chemically Stabilized Geomaterials against Moisture-Induced Damage.....	346
Samridh, Sayantan Chakraborty, Nripojyoti Biswas, Anand J. Puppala, Krishneswar Ramineni, and Aritra Banerjee	
Experimental Performance Evaluation of Geotechnical Encased Columns	357
Etienne Gonzalez, Abdurrahman Almikati, and Jorge Gabriel Zornberg	
Static and Cyclic Behaviour of Phosphogypsum-Stabilized Expansive Soil	365
Shubham Singh and Nihar Ranjan Patra	
Preliminary Modeling of Microbial-Induced Calcite Precipitation Injection Using Mangrove-Inspired Skirt Piles	377
Xiwei Li, Julian Tao, and Leon van Paassen	
Stabilization of Sandy Soil Using Synthetic Polymers with Opposite Charges.....	384
Jianxin Huang, Sopharith Chou, Vinay Krishnan, and Anand J. Puppala	
<i>Soil Properties and Modeling</i>	
Atterberg Limits: A Rheological Check of Their True Indication of Clay Consistency	395
Mohammadhasan Sasar and Sherif L. Abdelaziz	
A Review of Apparent Yield Stress Behavior in Low Void Ratio Clays.....	405
Brendan D. Atarigiyia, S. A. Osia, and Daniel R. VandenBerge	
Slurry Yield Stress: Rheometer versus Flow Test	417
Nuzhath Fatema, Shobha K. Bhatia, and Angel M. Palomino	
Machine Learning Enabled Modeling of C_c and C_r for Florida Soils Using Influential Parameters	426
Michael Morales, Scott Kirts, Siddharth Parida, and Ryan Shamet	

Comparative Particle Analysis of Glauconite and Ottawa Sands through X-Ray Micro-Computed Tomography	435
S. M. Shazeebur Rahman, Ryan D. Beemer, and Matthew Cabral	
Exploring the Relationship between MICP and Soil Microstructural Features—A 2D DEM Study.....	446
Marlee Reed, David Potyondy, and Brina Montoya	
Effect of Pore Water Salinity on the Residual Strength of Kaolinite.....	456
Mohammadreza Jebeli, Siamak Yoosefi, William J. Baker III, and Christopher L. Meehan	
Analyzing the Performance of Thermally Enhanced Prefabricated Vertical Drainage System Using a THM Model.....	465
Amin Mohammadzadeh and Omid Ghasemi-Fare	
Partially Drained Responses of Dense Sand under Monotonic Simple Shear	475
Wing Shun Kwan, Cesar Leal, Elizabeth Nunez, and Brandon De Jesus	
Assessing the Undrained Shear Strength of Saline Pierre Shale Soils	485
Uddav Ghimire and Tejo V. Bheemasetti	
Laboratory Experiments of Water Evaporation from High Plasticity Clayey Soil to Investigate Cracking Behavior.....	494
Md. Jobair Bin Alam, Aaliyha Jae Fuller, and Naima Rahman	
Enhancing Liquefaction Susceptibility Assessment: Application of Cyclic Direct Simple Shear Test on Silty Alluviums.....	505
Yasser Soltanpour, Erik Newman, Lance Finnefrock, and Mathew Francis	
Yielding Surfaces of Central Florida Sands and Silty Sands.....	516
Sergio Marin and Luis G. Arboleda-Monsalve	
Influence of Particle Morphology on Angle of Repose Derived from Hopper Flow Tests Using 3D DEM Simulations	527
Chitta S. Sandeep, R. Feng, J. J. Espinoza, M. L. Barry, and T. Matthew Evans	
Effect of Hydrate Morphology on Geomechanical Behavior of Gas Hydrate Sediments	535
Mahima S. Rao, Sahil Wani, and Ramesh Kannan Kandasami	
Assessing Temporal Variations in Dynamic Cone Penetration and Shear Wave Velocity on a Sandy Beach	545
Mohamad El Ahmad, Thomas Mayer, Jonathan Hubler, Nina Stark, and Tian-Jian Hsu	

Investigation of Soil Parameters Influencing Collapsibility of Loess through Grey Relational Analysis.....	555
Sahand Motameni, Fateme Rostami, Abbas Soroush, and Mahsa Eslami	

Unsaturated Soils

A New Model in Θ-STOCK to Numerically Model NAPL Contaminant Transport through Unsaturated Porous Media	564
Kiarash Jafarzadeh, Behrouz Gatmiri, Omid Ghasemi-Fare, and Mohammadreza Hassani	
Numerical Analysis of Vapor Diffusion Coefficient Influence on Thermo-Hydro-Mechanical Behavior of Expansive Soils.....	573
Fereydoun Najafian Jazi, Omid Ghasemi-Fare, and Thomas D. Rockaway	
Development of a Database for Soil Desiccation Crack Testing Results	584
Amirali Asadian, Farshid Vahedifard, and Chao-Sheng Tang	
Challenges in Numerical Simulation of Frost Heave.....	595
Antai Dong and Xiong Zhang	
Evaluation of Soil-Water Retention Characteristics of Fouled Ballast Using Axis Translation Technique	604
Mohammed Shakeel Abid and Stacey E. Kulesza	