

# **Geo-Congress 2026**

## **Soil Properties, Modeling, and Computational Geomechanics**

Selected Papers from Sessions of Geo-Congress 2026

Geotechnical Special Publication Number 376

Salt Lake City, Utah, USA  
9-12 March 2026

ISBN: 979-8-3313-3324-9

**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© (2026) by American Society of Civil Engineers  
All rights reserved.

Printed with permission by Curran Associates, Inc. (2026)

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](http://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](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# Contents

## *Shamsher Prakash Award*

<b>1st Prakash Lecture: The Influence of Soil Gradation on the Penetration Resistance and Dynamic Response of Level and Sloping Ground .....</b>	<b>1</b>
Jason T. DeJong, Alejandro Martinez, Katerina Ziotopoulou, Trevor Carey, and Daniel Wilson	

## *Computational Geotechnics*

<b>Development of a Modified Cam-Clay Model for Unsaturated Soils under Elevated Temperatures .....</b>	<b>24</b>
Toan Duc Cao	
<b>Classification of Densely Packed Sand Particles Using a Digital Camera and the Segment Anything Model (SAM) .....</b>	<b>34</b>
Linzhu Li and Maged Iskander	
<b>Comparative Analysis of AI Models for LiDAR and Drone-Based Change Detection in Slope Stability Assessment.....</b>	<b>45</b>
Suprobha Biswas Darothy, A. Q. M. Zohuruzzaman, and Sadik Khan	
<b>Synthetic Datasets and Machine Learning Algorithms for Enhanced Calibration of Plasticity Models for Liquefiable Geosystems.....</b>	<b>53</b>
Tyler Southam, Maziar Mivehchi, Laura Luna, and Katerina Ziotopoulou	
<b>Critical State Behavior of Granular Materials from Direct Shear, Simple Shear, and True Triaxial Discrete Element Simulations.....</b>	<b>63</b>
Esteban Patino-Marin, Fernando E. Garcia, David G. Zapata-Medina, and Luis G. Arboleda-Monsalve	
<b>Cross-Comparison of Plastic Hardening Models in FLAC3D and PLAXIS3D for Soil Behavior Simulation .....</b>	<b>74</b>
Mehrddad Karimipetanlar, Peter Kottke, and Mahsa Jerdi	
<b>Development and Application of Mesh Independent Non-Local Model in FLAC2D.....</b>	<b>83</b>
Sameer Lawankar, Prasoon Garg, Bhardwaj Pandit, and Gaurav Tiwari	
<b>Development of Deep Learning Based Model for Estimating Erosion Rates in Cohesive Soils .....</b>	<b>95</b>
Hiramani Raj Chimauriya, Nripojyoti Biswas, Anand J. Puppala, and Amit Gajurel	

<b>Differentiable Machine Learning in Geotechnical Engineering: A Case Study of Bearing Capacity Prediction of Shallow Foundation on Cohesionless Soils.....</b>	<b>103</b>
Jun Xiong and Te Pei	
<b>Effect of Friction Packing Limit and Drag Model for Predicting Soil Fluidization Behavior due to Pipeline Leakage .....</b>	<b>113</b>
Margi Dave and Ashish Juneja	
<b>Effect of Particle Refinement Method Parameters in Discrete Element Method Simulations: Cone Penetration Test Examples.....</b>	<b>120</b>
Pingki Datta and T. Matthew Evans	
<b>Evaluating Gas Blowout Craters in Permafrost Using the Material Point Method .....</b>	<b>131</b>
Yu Zhao, Min Liew, and Zhen Chen	
<b>Evaluation of a Numerical Modeling of the Radial Expansion and Axial Loading of a New Bioinspired Deep Foundation in Granular Soil .....</b>	<b>140</b>
Mohsen Zamani, Peter Zelkowski, Paola Bandini, and Craig Newton	
<b>Evaluation of Retrogressive Slope Failure in Sensitive Clays under Undrained Conditions with Smoothed Particle Hydrodynamics .....</b>	<b>149</b>
Enrique M. del Castillo and Jun Geng	
<b>Impact of Fluid Column Collapse on Structures Using Higher-Order MPM .....</b>	<b>159</b>
Abdelrahman Alsardi, Alba Yerro, and Christopher Long	
<b>Influence of Geometry and Mass Distribution on Penetrator Stability in FEM Simulations of Rapid Penetration in Clay .....</b>	<b>168</b>
Boules N. Morkos, Mehdi Omidvar, Stephan Bless, and Magued Iskander	
<b>Level Set Discrete Element Method Modeling of Naturally Deposited Sand in Triaxial Compression .....</b>	<b>180</b>
Peng Tan and Nicholas Sitar	
<b>Machine Learning Based Constitutive Models for Predicting Stress–Strain of Sands .....</b>	<b>189</b>
Yasaman Abdolvand and Mohammadhossein Sadeghiamirshahidi	
<b>Numerical Modeling of Heat Transfer by High-Voltage Cables around Buried Subsea Pipelines Including Trenching and SGD Heat Flux .....</b>	<b>198</b>
Kiarash Jafarzadeh and Omid Ghasemi-Fare	

**Probabilistic Tunnel Collapse Mechanism Based on Smoothed Particle Hydrodynamics and Random Field Theory .....208**  
Jun Geng, Enrique M. del Castillo, and Ronaldo I. Borja

**Seismic Settlement Analysis of Nihal Atakaş Mosque: A Comparison of Field Observations, Empirical and Semi-Empirical Estimates, and 3D Seismic Soil-Structure Interaction Simulation Results .....218**  
Ozgun Alp Numanoglu, Renmin Pretell, and Daniel Hutabarat

**Studying Underground Cavity Progression and the Effects under Levees: A Numerical Investigation Using the Material Point Method .....229**  
Carole Karam, Alba Yerro, and Sukrityranjan Samanta

*Soil Properties and Modeling*

**A Modified Split Hopkinson Pressure Bar for Temperature-Controlled Dynamic Testing of Frozen Sands .....240**  
Cocou D. R. Aza-Gnandji, Youssef Abouhussien, and Tugce Baser

**A Practical Correlation for Axial Strain at Failure in Drained Triaxial Compression of Sands.....250**  
Miguel A. Pando and Youngjin Park

**A Study of Laboratory Compaction Methods for Foamed Glass Aggregate .....261**  
Shafkat Bin Jafar, Haifang Wen, Michael P. McGuire, and Tuncer Edil

**AI-Powered Rapid Evaluation Scheme for Multiscale Properties of Porous Civil Engineering Materials: Integrating RGB Imaging, Voronoi Random Finite Element (VrFEM), and Numerical Virtual Experiments .....271**  
Yusheng (Bear) Jiang, Xiong (Bill) Yu, Sreelakshmi Sreeharan, Kiranmayee Madhusudhan, and Hui (Jack) Wang

**An Experimental Investigation on Solar Panel (H-Shape Steel) Pile and Frozen Soil Interaction .....282**  
Zihao Shang, Leela Krishna Mohan Radarapu, Chang Huang, Jeffrey Liu, Alfred Williams, Rohit Pant, and Marcelo Sanchez

**An Investigation on the Interactions between Two Root Elements in Sand during Pullout.....291**  
Suja Liu, Alejandro Martinez, and Jason DeJong

**Analysis of Video Images Obtained during Cone Penetration Testing .....301**  
Gerald Verbeek and Oksana Khomiak

<b>Application of a Concrete Constitutive Model to Marine Clays Treated with Calcium Carbide Residue .....</b>	<b>311</b>
Charity Marbaniang and Ashish Juneja	
<b>Determining the Preconsolidation Stresses of Low Void Ratio, Highly Overconsolidated Clays .....</b>	<b>319</b>
Seyed Ahmad Osia and Daniel R. VandenBerge	
<b>Effect of Freezing, Drainage Distance, and Radial Location on the Specific Surface Area of Kaolinite Clay.....</b>	<b>329</b>
Sepehr Akhtarshenas and Sherif L. Abdelaziz	
<b>Effect of Strain Rate on Stress–Strain and Pore Pressure Response of Very Soft Clay .....</b>	<b>338</b>
Shrweta Dutta and Ajanta Sachan	
<b>Effect of Undesired Compaction on Hydraulic Properties of Roadside Soils .....</b>	<b>348</b>
Oguzhan Saltali, Angela Farina, Mikayla Cunningham, Vincent Mwangi, Ahmet H. Aydilek, Allen P. Davis, and Bora Cetin	
<b>Evaluating the Influence of Porous Stone Contact Area on Shear Strength Measurements Using a Ring Shear Device .....</b>	<b>358</b>
Milad Tajik, Yuderka Trinidad González, Casandra Rutherford, and Vernon R. Schaefer	
<b>Experimentally Studying the Thermal Sensitivity and Mechanical Response of Kaolin Clay due to Climatic Warming .....</b>	<b>367</b>
Mohd Sheob, Sarah Aldawood, and Srikanth S. C. Madabhushi	
<b>Freezing Curves of Ottawa Sand with Varying Organic Matter and Salinity.....</b>	<b>376</b>
Junaidul Islam, Tunay Turk, Anshu Abhinav, and Tugce Baser	
<b>Harnessing Nitrogen Cycle Reactions to Support the Metabolism of Synthetic Urine for Microbially Induced Carbonate Precipitation of Lunar Soil Simulant.....</b>	<b>385</b>
Micaela Robson, Marlee Reed, Elizabeth Trubchaninov, Amy Grunden, and Brina Montoya	
<b>Image-Based Moisture Content Prediction in Railway Ballast Using Deep Learning .....</b>	<b>396</b>
Kelin Ding and Erol Tutumluer	
<b>Impact of Soil Composition on the Shear Strength of Frozen Soils .....</b>	<b>407</b>
Hossein Emami Ahari and Beena Ajmera	

**Impacts of Delayed Inundation during One-Dimensional Consolidation Testing.....416**  
 Asli Acikel, Martin J. Walker, Kevin Stanton, and Robert Chew

**Enhancing Soil-Concrete Interface Friction Using a Biomimetic  
 Diamond Snakeskin Texture.....425**  
 Allison Kunz, Jenna Dayley, Kenny Quintana, Kyle M. Rollins,  
 and Taylor J. Sorensen

**Influence of Effective Confinement Pressure on Geomechanical  
 Characteristics of Hydrate-Bearing Sediments.....433**  
 Mahima S. Rao, Sahil Wani, and Ramesh Kannan Kandasami

**Investigation of the Effect of Pore Water Salinity on the Water  
 Retention Behavior of Bentonite.....443**  
 Mohammadreza Jebeli, Siamak Yoosefi, and Christopher L. Meehan

**Lessons Learned in Applying Gravel Interference Corrections for  
 Cone Penetration Test .....452**  
 Bret Lingwall and Kody Vandervort

**Micro-to-Macro Exploration of Shear Behavior at Sand-Steel Interfaces.....462**  
 Lalit Kandpal, Prashanth Vangla, and Satoshi Matsumura

**Non-Invasive Characterization of Soil Moisture Content and Density  
 Using Thermal Imaging, Simulation Modeling, and Machine Learning.....472**  
 Yusheng Jiang, Qingyu Ren, and Hui Wang

**Optimization-Based Parameter Calibration of the Hypoplastic  
 Model for Central Florida Hawthorn Group Soils.....482**  
 A. J. Aparicio-Ortubé, Luis G. Arboleda-Monsalve, and David G. Zapata-Medina

**Particle Size Effects on the Strength of Sand-Structure Interfaces with  
 Snakeskin-Inspired Surfaces.....493**  
 Hyeon Jung Kim and Alejandro Martinez

**Physics-Informed Neural Network Approach for Geotechnical  
 Parameter Estimation in Soil Consolidation Analysis.....502**  
 Jin Kim, Jung-Tae Kim, Minshik Rho, Hyun-Joong Hwang, and Gye-Chun Cho

**Plant Species Influence on Microbially Induced Carbonate Precipitation:  
 X-Ray Diffraction Analysis of Mineral Formation and Composition.....511**  
 Hannah Hiscott, Pegah Ghasemi, Brina M. Montoya, Celso Castro-Bolinaga,  
 William K. Petry, Amy M. Grunden, Benjamin Breland, and Allison Scates

**Preliminary Findings on the Application of mHVSr for Data-Driven Site Response Prediction in California .....522**  
 Francisco Javier G. Ornelas, Christopher A. de la Torre, Zhaoting (Steve) Zhang, Tristan E. Buckreis, Scott J. Brandenburg, and Jonathan P. Stewart

**Printability and Structural Integrity of Fiber-Reinforced Earth-Based Materials for 3D Printing.....532**  
 Suvechha Dhakal and Nitin Tiwari

**Residual Strength of Xanthan Gum-Treated Soils .....544**  
 Kiran Kuikel, Connor McQuinn, Bernardo Castellanos, and Lucas Walshire

**The GeoPoncelet Model for Rapid Penetration in Soils.....554**  
 Joseph Thomas Dinotte, Mehdi Omidvar, Stephen Bless, and Magued Iskander

**Understanding Soil Spatial Variability and Uncertainty: The Role of Borehole Spatial Distribution in Single Pile Design.....565**  
 Fabiana Viscarra, Tommy D. Bounds, and Kanthasamy K. Muraleetharan