# **Geo-Congress 2022**

Geoenvironmental Engineering; Unsaturated Soils; and Contemporary Topics in Erosion, Sustainability, and Coal Combustion Residuals

Selected Papers from Sessions of Geo-Congress 2022

Geotechnical Special Publication Number 335

Charlotte, North Carolina, USA 20 – 23 March 2022

**Editors:** 

Anne Lemnitzer
Armin W. Stuedlein

ISBN: 978-1-7138-4477-8

#### 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© (2022) by American Society of Civil Engineers All rights reserved.

Printed with permission by Curran Associates, Inc. (2022)

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**

## Geoenvironmental Engineering

Enhanced Landfill Methane Oxidation Using Activated Biochar
Effect of Inorganic Solutions on the Free Swell Index of Polymerized Clays
Predicting Hydraulic Conductivity of Geosynthetic Clay Liners Using a Neural Network Algorithm2
Yu Tan, Jiannan Chen, and Craig H. Benson
Applying Geofoam to Construct Bridge Approaching Embankments on Soft Ground in Ho Chi Minh City29
Phong D. Nguyen, Hoang-Hung Tran-Nguyen, and Vinh P. Phan
Acidic Flow-Induced Clogging of Permeable Reactive Barriers in Pyritic Terrain39 Subhani Medawela, Buddhima Indraratna, and Senura Athuraliya
Geoenvironmental Impacts of Post-Wildfire Hillslope Stabilization with  Xanthan Gum and Polyacrylamide
Alishan Alinicu, Aliianda K. Hollici, Feter K. Kobienauu, and idii Deliiz Akin
Hydraulic Performance of Alginate-Based Bentonite
Critical Review on the Behavior of Lithium (Li) Ion in Plastic Soils
Effect of Exchangeable Cation on Carbon Dioxide Adsorption in Smectite Clay
Soil Bentonite Slurry Trench Cutoff Walls: History, Design, and Construction Practices89
Christopher Ryan, Daniel Ruffing, and Jeffrey C. Evans
Advancing the State-of-the-Art in Bentonite Barrier Research: Measuring  Membrane Behavior and Diffusion at Elevated Temperatures10
Sayed Arafat B. Rahman, Kristin M. Sample-Lord, and Gretchen L. Bohnhoff

Located in Humid Climate111
Milind V. Khire, Terry Johnson, William Meyer, and Richard Holt
Field Measurement of Municipal Solid Waste Properties Using a Direct Injection Method with Hydraulic Profiling Tool (HPT) and Cone Penetration Test (CPT) in a Closed Landfill
Influence of Electrochemical Remediation on the Hydraulic and Mechanical Behavior of a Metal-Contaminated Clayey Soil129
Taiwo O. Akinleye, Amanda K. Hohner, Xianming Shi, and Idil Deniz Akin
Review of the Equations Used to Calculate Hydraulic Conductivity  Values from Two-Stage Borehole Tests140
Johnathan Blanchard, Matthew Nanak, and Richard A. Coffman
Multiphysics Numerical Modeling of Transient Transport of PFAS149 Pierrette Iradukunda and Arvin Farid
Integrity of HDPE Pond Liner Systems during and after PFAS Flocculation and Stabilization
Effects of Sample Thickness and Shape on Cracking Patterns and Crack  Depth in a Compacted Clay169
C. Clay Goodman and Farshid Vahedifard
Groundwater Property Alteration When Crushed Recycled Shingles Are Used as a Fill Material
Effect of Addition of Phosphogypsum on Strength and Deformation  Behavior of Expansive Soils
Sealing and Volume Change Behaviour of Polymer-Amended Granular  Bentonite under Extreme Chemical Loading
Comparison of Gas Emissions from Conventional and Alternative Landfill  Final Covers: Modeling Estimates

Effects of Different Calcium Sources and Cementation Environments on
Microbially Induced Calcium Carbonate Precipitation219 Xichen Xu, Hongxian Guo, and Xiaohui Cheng
Alchen Au, Hongxian Guo, and Alaondi Cheng
Unsaturated Soils
Collapse Settlement Prediction of Footings Built over Natural and
Compacted Soils
Roger Augusto Rodrigues, Fabio Visnadi Prado Soares, and Marcelo Sanchez
Soil Water Characteristic Curves of Earthen Cover Subjected to Varying Environmental Conditions
Md. Jobair Bin Alam, Md. Aminul Islam, and Asif Ahmed
Effective Stresses of an Unsaturated Expansive Soil Determined from Volume Change and Shear Response247
Mohsen Ajdari, Hossein Bahmyari, and Ghasem Habibagahi
Gas Flow through Unsaturated Scaled Barrier for the Disposal of High-Level
Nuclear Waste258
Muhammad A. Falak, Marcelo Sanchez, and Enrique R. Morales
Influence of Soil Hydraulic Characteristics in Modelling Capillary  Barrier Systems
G. Vishnu and Tadikonda Venkata Bharat
The Influence of Cyclic Loading Frequency on the Response of an
Unsaturated Railway Formation Soil
Ashutosh Kumar, Arash Azizi, and David Toll
Centrifuge Modeling to Evaluate the Seismic Response of Elastic
and Inelastic Structures Embedded in Unsaturated Soil284
Matthew M. Turner, Majid Ghayoomi, Kyohei Ueda, and Ryosuke Uzuoka
Using a 3D Hydro-Mechanical Model to Study the Cyclic Behavior of
Unsaturated Soils
Beshoy Riad and Xiong Zhang
Unguided Cracking in Unsaturated Soils through a Coupled
Nonlocal Poromechanics Model
Shashank Menon and Xiaoyu Song
Water Retention in Expansive Clay under Elevated
Temperatures and Constrained Conditions

Soil-Water Retention Surface of Unsaturated Clay Incorporating Capillary Interface Area through Molecular Dynamics
Analysis of the Depth of the Active Zone via Coupled Hydro-Mechanical Analysis
Effect of Heating and Drying on Clay-Barrier Gas-Permeability343 Bohan Zhou, Abdulvahit Sahin, and Marcelo Sanchez
Geotechnics of Soil Erosion
CFD-DEM Simulation of Some Erosion Applications
Simulation of Soil Fluidization around a Pressurized Leaking Pipe Using the Material Point Method
Bingham-Plastic and Spring-Dashpot Models in SPH Method: Simulation of Bed Load Material beneath the Violent Flows
Numerical Simulations of Mangrove-Inspired Sacrificial Pile Group for Scour Mitigation
Using Machine Learning in Estimating Changing Bed Shear over a  Flume Test Box
Bio-Cementation for Protection of Coastal Dunes: Physical Models and Element Tests
The Effect of Grain Size on Rainfall-Triggered Debris Flow in  Hydrophobic Granular Slopes417
Mahta Movasat and Ingrid Tomac  Evaluation of Post-Impact Behavior of Single Droplet on the  Hydrophobic Soil Surface

## Sustainability in Geotechnical Engineering

Field Trial on Rapid Soil Classification Using Computer Vision43	33
You Jin Eugene Aw, Soon Hoe Chew, Kok Eng Chua, Pei Ling Goh, Lye Meng Cheng, and Si En Danette Tan	
Microstructural Evolution of Kaolinite Clay under a Thermal Cycle44 Seyed Morteza Zeinali and Sherif L. Abdelaziz	<b>12</b>
Sustainability Benefits of Utilizing Coal Gangue as Fill Material in Earthworks45 Mohammed Ashfaq, Arif Ali Baig Moghal, and Abdullah Almajed	53
Coal Combustion Residuals	
Determining the In Situ State of Coal Combustion Residuals Using	<b>~</b>
Cone Penetration Testing	53
Use of Additives in Minimizing the Flow of Impounded Fly Ash Slurries47 Nuzhath Fatema and Shobha K. Bhatia	74
Water Retention and Hydraulic Conductivity Characteristics of Ponded Fly Ash	84
Investigating the Use of Centrifuge Modeling and Miniature CPTs to Characterize the Run-Out Behavior of Fly Ash	95
Hydraulic Properties of Sluiced Coal Combustion Products Disposed in Impoundments	05
Preliminary Results of Compacted Coal Fly Ash/Flue Gas Desulfurization Brine Co-Disposal in an Instrumented Testbed	14
Classification and Characterization of Ponded Coal Combustion Residuals Using In Situ Methods	25
Piedmont Geotechnics	
Design and Construction of a Soldier Pile and Lagging Wall in Piedmont  Residual Soil	36