

Geo-Congress 2022

Soil Improvement, Geosynthetics, and Innovative Geomaterials

Selected Papers from Sessions of Geo-Congress 2022

Geotechnical Special Publication Number 331

Charlotte, North Carolina, USA
20 – 23 March 2022

Editors:

Anne Lemnitzer
Armin W. Stuedlein

ISBN: 978-1-7138-4480-8

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

Soil Improvement

Identifying Rigid Inclusion Design and Construction Risks for Support of Shallow Foundations in New England	1
Kelvin C. Wong, Damian R. Siebert, Michael Pockoski, Ken Kniss, and Kord Wissmann	
Hybrid Ground Improvement Solution in Deep Compressible Glacial Lake Clay	14
Thierno I. Kane, Terence P. Holman, Yan Zhang, and Spring Borchardt	
Sports Complex Supported on Rigid Inclusions in Deep Soft Clay Profile.....	27
Robert B. Condon, Brian Metcalfe, and Steven H. Werling	
Rigid Inclusions and High Strength/Modulus Geosynthetic Reinforced Load Transfer Platform System for Very High Embankments	38
Lilma R. Schimmel and Alex Potter-Weight	
Performance of Stone Columns in Multi-Layered Soils System	50
P. Kiruthika, Subhadeep Banerjee, Adapa Murali Krishna, and Adimoolam Boominathan	
The Interaction between the Stone Column and Surrounding Soil in the Composite System	61
Wjdan Dhaif Sahi and Haluk Aktan	
Settlement and Bearing Capacity of Stone Columns Foundation	73
Wjdan Dhaif Sahi and Bilal M. Alhawamdeh	
Field Experiment and Numerical Modeling of a Single Aggregate Pier.....	84
William Gamboa Ellis, Mohammad Khosravi, Coby Burns, and Taj Mukadam	
Shrinkage Characteristics of Biopolymer Treated Expansive Soil	92
K. Venkata Vydehi, Arif Ali Baig Moghal, and Romana Mariyam Rasheed	
Effect of Lime on Crack Propagation in Compacted Expansive Soil over a Range of Moisture Fluctuation: An Image-Based Approach	100
Brijesh Kumar Agarwal and Ajanta Sachan	

Investigations on Carbonation of Lime Stabilized Expansive Soil from Micro-Level Perspectives	110
Dhanalakshmi Padmaraj and D. N. Arnepalli	
Soil Improvement by Re-Orienting Magnetic Particles Using a Magnetic Field.....	120
Xinyi Jiang and Cassandra Rutherford	
Influence of Organic Matter on Strength Development of Cement-Water Slurry	129
Hwanik Ju, Alexander S. Brand, Sherif L. Abdelaziz, and George M. Filz	
Strength Development and Reaction Kinetics in Lime-Treated Clays	138
Tasneem Ahmadullah and Maria Chrysochoou	
Effect of Polypropylene Fiber and Curing on the Unconfined Compressive Strength of Geopolymer Stabilized Kaolin Clay.....	148
Adedeji A. Disu, Prabir Kolay, Vijay Puri, and Sanjeev Kumar	
Investigation of Microstructure of Dredging Sand Mixing Cement Specimens to Interpret Reduction of Permeability.....	157
Bich T. Luong and Hoang-Hung Tran-Nguyen	
Impact of Colloidal Silica Treatment on an Earthfill Dam.....	167
Alessandro Fraccica, Giovanni Spagnoli, Enrique Romero, and Marcos Arroyo	
Grouting Soil with Dilute Suspension of Clay Nanoparticles to Improve against Wetting-Induced Collapse.....	179
Ali Seiphoori and Mostafa Zamanian	
Improving the Performance of Deep Soil Mixing in Clay with Chemical Additives	186
Giovanni Spagnoli, Erminio Salvatore, Michela Arciero, and Giuseppe Modoni	
Use of Quarry Byproduct (No. 10 Screenings) to Improve Subgrade Soil.....	196
M. Shabbir Hossain	
Injection of Non-Conventional Binders to Improve Geomechanical Properties of Cataclasite.....	205
Davide Grassi, Giovanni Spagnoli, and Riccardo Castellanza	
Surfactant-Induced Soil Strengthening (SISS)—A Potential New Method for Temporary Stabilization along Beaches and Coastal Waterways.....	212
Joshua C. Sasser, Raphael Crowley, Matthew Davies, Nick Hudyma, and Ryan Shamet	

Utilization of Metakaolin-Based Geopolymers for Stabilization of Sulfate-Rich Expansive Soils.....	222
Jungyeon Jang, Anand J. Puppala, Nripojyoti Biswas, Sayantan Chakraborty, and Miladin Radovic	
Engineering and Mineralogical Evaluation of a Rapid-Strength Stabilizer for Expansive Clays.....	232
Pavan Akula, Saureen Naik, Shayan Gholami, Yong-Rak Kim, Dallas Little, and John Rushing	
Laboratory Investigation on Fiber-Reinforced Expansive Subgrade Soil Stabilized with Alkali Activated Binder: A Reliability-Based Perspective	241
Mazhar Syed, Manan Ahuja, Aditya R. Jambholkar, and Anasua GuhaRay	
Hydromechanical and Pore-Structure Evolution in Lime-Treated Kneading Compacted Soil.....	251
Geetanjali Das, Andry R. Razakamanantsoa, Gontran Herrier, and Dimitri Deneele	
Permeability Characteristics of Polymer Emulsion-Stabilized Soils	261
Prince Kumar, Jeb S. Tingle, Anand J. Puppala, Sayantan Chakraborty, and Surya Sarat Chandra Congress	
A Evaluation of a Quarry Byproduct Material for Use in an Inverted Pavement System	271
Ismaail I. Ghaaowd, Michael T. Adams, Jennifer E. Nicks, and Emily A. Cox	
Experimental Study on Enzyme-Induced Calcium Carbonate Precipitation Based on Rate Regulation at Different Temperature Environment	281
Hengxing Wang, Linchang Miao, Xiaohao Sun, and Linyu Wu	
Soil Bonding Using Bio-Inspired Flexible Calcite (BiFC) Precipitation.....	291
Kewei Gao, Muhannad T. Suleiman, Derick G. Brown, and Abdolhamid Sadeghnejad	
Mechanical Behavior of Fiber Reinforced Bio-Cemented Sand.....	300
Chao Lv and Chao-Sheng Tang	
Compressibility Behavior of MICP-Treated Sand Treated under Unsaturated Conditions.....	309
Pegah Ghasemi, Qianwen Liu, and Brina M. Montoya	
Effect of Salt Water on the Process of Microbially Induced Carbonate Precipitation	318
Jinung Do and Tae-Hyuk Kwon	

Stabilization of Mine Tailings Using Microbiological Induced Carbonate Precipitation for Dust Mitigation: Treatment Optimization and Durability Assessment	326
Farideh Ehsasi, Leon van Paassen, and Liya Wang	
The Effect of Microbial Induced Carbonate Precipitation on Fine-Grained Mine Tailings.....	335
Conor O’Toole, Qianwen Liu, Brina M. Montoya, Negin Kananizadeh, and William Odle	
Experimental Investigation of Microbial Induced Desaturation and Precipitation (MIDP) in a Layered Granular Soil System.....	347
Elizabeth G. Stallings Young, Claudia E. Zapata, and Leon A. van Paassen	
Thermal Properties of Bio-Cemented Sand	356
Pinar Gunyol, Mohammad Khosravi, Adrienne Phillips, and Kathryn Plymesser	
Evaluation of the Treatment Processes for MICP- and EICP-Treated Sands.....	365
Isaac Ahenkorah, Md. Mizanur Rahman, Md. Rajibul Karim, and Simon Beecham	
Sensitivity Analyses of Hypoplastic Model Parameters to Simulate the Stress–Strain Behavior of MICP-Treated Sand.....	375
Faria Ahmed, Brina M. Montoya, and Mohammed A. Gabr	
Investigating the Dissolution Behavior of Calcium Carbonate Bio-Cemented Sands.....	385
Bruna G. O. Ribeiro and Michael G. Gomez	
Reactive Transport Modeling of Microbial Induced Calcium Carbonate Precipitation Utilizing Various Configurations of Injection Wells	396
Zahra Faeli, Brina M. Montoya, and Mohammed A. Gabr	
Combination of Enzyme-Induced Calcium Carbonate Precipitation (EICP) and Macro-Synthetic Fibers for Soil Improvement	408
Emran Alotaibi, Mohamed G. Arab, and Maher Omar	
Electro-Osmosis Dewatering and Consolidation—G-I China Scan Tour Overview	418
Jie Huang, Lisheng Shao, Jie Han, Jose Clemente, and Yanfeng Zhuang	
Comparison of Consolidation Settlement Obtained Using Varying Models.....	431
Swapnil Mishra and Awantika Mishra	
Formation of Internal Filter Cake due to Particle Migration in Porous Media	439
N. Selvakumar, Neeraj Pulaganti, and Ramesh Kannan Kandasami	

Engineered Water Repellency for Mitigating Frost Action in Iowa Soils448
 Ty Brooks, John L. Daniels, Micheal Uduebor, Bora Cetin,
 and Mohammad Wasif Naqvi

Engineered Water Repellency in Frost Susceptible Soils.....457
 Micheal Uduebor, John Daniels, Mohammad Wasif Naqvi, and Bora Cetin

Geosynthetics

**Strength Enhancement of Geogrid Reinforced Marginal Backfill
 Materials in Triaxial Condition.....467**
 S. Sarkar and A. Hegde

**Comparison of Pullout Behaviour of Polyester Geogrid and Polyester
 Strip Soil Reinforcement477**
 Apoorva Agarwal, Manoj Datta, G. V. Ramana, and Narendra Kumar Soni

DEM Modelling on the Interface Behavior of Geogrid-Stabilized Sub-Ballast.....486
 Trung Ngo, Buddhima Indraratna, and Cholachat Rujikiatkamjorn

**Pilot Project and Field Study: Data and Quality-Based Geomembrane
 Field Seaming Evaluation for CCR Projects.....496**
 Evan Andrews and Kenneth R. Daly

**The Ground Reaction Curve and Mobilization of Soil Arching in
 Geosynthetic-Reinforced Column-Supported Embankments508**
 Michael P. McGuire, Joel A. Sloan, Eric M. Hunstein, and Luke Socolofsky

Cost Analysis of Geocell Reinforced Layer in Highways520
 Sundeep Inti and Vivek Tandon

Recent Experiences with Geofoam Blocks as Retaining Wall Backfill.....531
 Allen Cadden, Michael Senior, B. Philip Shull Jr., and Brendan Stepek

Wind Tunnel Study and Uplift Analysis of Geosynthetic Covers543
 Ming Zhu, Partha Sarkar, Fangwei Hou, and Junxing Zheng

**Numerical Simulation of Full-Scale Testing Performed on Multi-Axial
 Geogrid Stabilized Pavements554**
 Prajwol Tamrakar, Mark H. Wayne, and W. Jeremy Robinson

**Effects of Prehydration on Hydraulic Conductivity of Bentonite-Polymer
 Geosynthetic Clay Liner to Coal Combustion Product Leachate568**
 Dong Li and Kuo Tian

Innovative Geomaterials and Geosynthetics

Influence of Adding the Lightweight Tectosilicate-Structured Zeolite on the Plasticity of Flaky-Structured Clay	578
Abdulla A. Sharo, Fathi M. Shaqour, and Jomana M. Ayyad	
Technical Review of Development and Applications from Wicking Fabric to Wicking Geotextile	587
Md. Wasif Zaman, Jie Han, and Xiong Zhang	
Pore-Scale Modeling of Polymer Clogging in Bentonite-Polymer Composite Geosynthetic Clay Liners	597
Juan Hou, Hao Li, Sarah Gustitus, and Craig H. Benson	
Reinforced Composites for Resilient Reinforced Soil Slopes to Prevent Rainfall Induced Failures.....	605
K. A. Dhanya and P. V. Divya	
Effect of Macro-Synthetic Fibers on Treated Sandy Soil with Alkali Activated Binders.....	615
Yousef Elbaz, Mohamed G. Arab, and Maher Omar	
Soil Water Retention Curve and Hydraulic Conductivity of Fungi-Treated Sand	624
Joon S. Park and Hai Lin	
Investigating Geotechnical Properties of Nest Soils Used by Mud Dauber Wasps	635
Joon S. Park, Noura S. Saleh, Hai Lin, and Hussein Alqrinawi	
Lightweight Cellular Concrete Properties and Geotechnical Applications	646
Yu-Qiu Ye, Jie Han, and Robert L. Parsons	
Microstructure and Dissolution of Aluminosilicate Geopolymers Made from Mine Tailings Source Material	655
Cara Clements, Ahmadreza Hedayat, and Lori Tunstall	