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
## 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

Jungyeon Jang, Anand J. Puppala, Nripojyoti Biswas, Sayantan Chakraborty, and Miladin Radovic

Engineering and Mineralogical Evaluation of a Rapid-Strength Stabilizer for Expansive Clays

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

Mazhar Syed, Manan Ahuja, Aditya R. Jambholkar, and Anasua GuhaRay

Hydromechanical and Pore-Structure Evolution in Lime-Treated Kneading Compacted Soil

Geetanjali Das, Andry R. Razakamanantsoa, Gontran Herrier, and Dimitri Deneele

Permeability Characteristics of Polymer Emulsion-Stabilized Soils

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

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

Hengxing Wang, Linchang Miao, Xiaohao Sun, and Linyu Wu

Soil Bonding Using Bio-Inspired Flexible Calcite (BiFC) Precipitation

Kewei Gao, Muhamnad T. Suleiman, Derick G. Brown, and Abdolhamid Sadeghnejad

Mechanical Behavior of Fiber Reinforced Bio-Cemented Sand

Chao Lv and Chao-Sheng Tang

Compressibility Behavior of MICP-Treated Sand Treated under Unsaturated Conditions

Pegah Ghasemi, Qianwen Liu, and Brina M. Montoya

Effect of Salt Water on the Process of Microbially Induced Carbonate Precipitation

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 Kananzadeh, 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

© ASCE
Engineered Water Repellency for Mitigating Frost Action in Iowa Soils ........................................448
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 Reinforcement .................................................................477
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 Embankments .....................................508

Cost Analysis of Geocell Reinforced Layer in Highways .............................................................520
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 Covers ..........................................................543
Ming Zhu, Partha Sarkar, Fangwei Hou, and Junxing Zheng

Numerical Simulation of Full-Scale Testing Performed on Multi-Axial Geogrid Stabilized Pavements .................................................................554
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 Leachate ...........................................568
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

© ASCE