Ground Improvement and Geosynthetics

Selected Papers from the 2014 Geoshanghai International Congress

Geotechnical Special Publication Number 238

Shanghai, China 26 – 28 May 2014

Editors:

Jie Han Anand J. Puppala Shui-Long Shen Sadik Oztoprak Jie Huang

ISBN: 978-1-63266-669-7

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© (2014) by the American Society of Civil Engineers All rights reserved.

Printed by Curran Associates, Inc. (2014)

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

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

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: 845-758-2634

Email: curran@proceedings.com Web: www.proceedings.com

GSP 238 Table of Contents

Keynote Lecture

1 Ground Improvement for Rail, Port, and Road Infrastructure—From Theory to Practice

Buddhima Indraratna, Cholachat Rujikiatkamjorn, and Sanjay Nimbalkar

Ground Improvement with Pile or Column Technology

20Design Charts for a Foundation System Reinforced with Peripheral Vertical Inserts

Prashant Garg, Harvinder Singh, and J. N. Jha

30Numerical Analysis of Piled Embankments on Soft Soils

Wisam Al-Ani, Dariusz Wanatowski, and Swee Huat Chan

40Experimental Research of Bearing Behavior on Lime-Soil Pile and CFG Pile Rigid-Flexible Pile Composite Subgrade

Feng-xiang Yan and Xian-zhi Huang

49Numerical Analyses of Soil Arching in Rigid Pile Supported Embankments

Shitong Song and Chao Xu

57A Note on Pile Length Optimization of Pile Groups Considering the Non-Linear Behavior of Piles

Fayun Liang, Haibing Chen, Zhu Song, and Jie Han

67<u>Vibro-Replacement Ground Improvement within Layered and Interbedded Variably Cemented Sedimentary Limestone and Granular Soils</u>

Matthew E. Meyer, Lijian Zhou, and Mark E. Plaskett

78 Numerical Analysis of Failure Modes of Deep Mixed Column-Supported Embankments on Soft Soils

Zhen Zhang, Jie Han, and Guanbao Ye

88Experimental Study on the Horizontal Bearing Capacity of a Cement-Soil Pile Reinforced with Fiberglass Geogrid

Chao Yan, Song-yu Liu, and Yong-feng Deng

98Consolidation of Soft Foundations Treated with Composite Columns

Gang Zheng, Yan Jiang, and Jie Han

Ground Improvement with Chemical, Electrical, or Biological

Technology

107 Current State of the Art in Jet Grouting for Stabilizing Soft Soil

Shui-Long Shen, Zhi-Feng Wang, and Chu-Eu Ho

117<u>Laboratory Tests and Numerical Analysis on the Grouting Reinforcement Effect for Soft-Soil Subgrade</u> Settlement of a High-Speed Railway

Zhuohua Tang, Qianwei Xu, Xinan Yang, and Jun Zhang

128 Jet Grouting for the Mitigation of Excavation Wall Movements in Glacial Silts

Chu E. Ho and Shuang Hu

138Effect of Volcanic Ash Utilization As Substitution Material for Soil Stabilization in View Point of Geo-Environment

A. Rifa'i and N. Yasufuku

148 Initial Investigation of Soil Stabilization with Calcined Dolomite-GGBS Blends

Kai Gu, Fei Jin, Abir Al-Tabbaa, and Bin Shi

158Laboratory Research on Resilient Modulus of Lime-Stabilized Soil

Jingsong Qian, Guoxi Liang, Jianming Ling, and Shuo Wang

168 Modelling Behaviour of Cemented Clay Capturing Cementation Degradation

Lam Nguyen, Behzad Fatahi, and Hadi Khabbaz

178Experimental Investigation of Sand-Nanosilica Mixture under Long-Term Unfavourable Environments

M. Y. Cheng and N. Saiyouri

188Experimental Study of the Electro-Osmosis Consolidation of Soft Clay under Anode Follow-Up

Fei-yu Liu, Wei Mi, Le Zhang, and Jun Wang

198 Influence of Polarity Reversal and Current Intermittence on Electro-Osmosis

Yan-li Tao, Jian Zhou, Xiao-nan Gong, Zhuo Chen, and Ping-Chuan Hu

209 Numerical Modeling of Artificial Ground Freezing: Multiphase Modeling and Strength Upscaling

M.-M. Zhou and G. Meschke

220Study on Strength Characteristics and Microcosmic Mechanisms of Silt Improved by Lignin-Based Bio-Energy Coproducts

Tao Zhang, Songyu Liu, Guojun Cai, and Anand J. Puppala

Ground Improvement with Other Technology

231Case Study of Ground Improvement in Qianhai Reclamation Area, Qianhai Bay, Shenzhen

A. G. Li, L. G. Tham, J. P. Wen, and S. C. Chen

241Model Test of Soft Soil Improved by High Energy Dynamic Replacement Method

Guanbao Ye and Yan Xu

249 <u>Durability Studies on Native Soil-Based Controlled Low Strength Materials</u>

Bhaskar Chittoori, Anand J. Puppala, Aravind Pedarla, and Durga Praveen Reddy Vanga

258 Impact Roller Compaction of Dry Sand in Laboratory Tests

Zhong-ging Chen, Chao Xu, Guan-bao Ye, and Chao Shen

270 Improving Expansive Shale Behaviour Using Soil Replacement and Rock Fill

Muawia Dafalla, Mosleh Al-Shamrani, and A. Al-Omar

278Subgrade Performance and Treatment of Silty Clay with Low Liquid Limit in Widening

Jian-ming Ling, Wen-yu Li, Qin-long Huang, and Xin Luo

Geosynthetic Reinforcement

289<u>Protection of Buried Pipelines Using a Combination of Geocell and Geogrid Reinforcement: Experimental</u> Studies

A. Hegde, S. Kadabinakatti, and T. G. Sitharam

299Study of Geogrid Reinforcement Using Two-Dimensional Discrete Element Method

Xinbao Yu and Asheesh Pradhan

312 Model Tests of Subsidence of Reinforced Soil over Voids

Vinh Le, Jie Huang, Sazzad Bin-Shafique, and A. T. Papagiannakis

322Model Studies on Geocell Reinforced Granular Sub-Bases

M. N. Asha and G. Madhavi Latha

333Behavior of Geogrid Reinforced Ballast at Different Levels of Degradation

Yu Qian, Erol Tutumluer, Debakanta Mishra, and Hasan Kazmee

343 Vegetation Tests of Geocell-Reinforced Unpaved Shoulders

Jun Guo, Jie Han, Steven D. Schrock, and Robert L. Parsons

353 Experimental Study on the Resilient Behavior of Triaxial Geogrid-Stabilized Unpaved Roads

Xiaohui Sun, Jie Han, Mark H. Wayne, Robert L. Parsons, and Jayhyun Kwon

363Evaluating Geogrid Performance with Loaded Wheel Tester

Xiang Shu, Hao Wu, Sheng Zhao, and Baoshan Huang

370Application of Jute Geotextiles for Rural Road Pavement Construction

A. J. Khan, F. Hug, and S. Z. Hossain

380 Effect of Reinforcement Form on the Pullout Resistance of Reinforced Sand

Y. L. Lin, X. X. Li, and M. X. Zhang

389Behaviour of Prestressed Reinforced Foundation Beds Overlying Weak Soil

R. Shivashankar and J. Jayamohan

404Comparison of Strip-Reinforced with H-V Reinforced Foundations Using FEM

Juan Hou, MengXi Zhang, and Tao Tao Zhang

414Stabilization of Erodible Slopes with Geofibers and Nontraditional Liquid Additives

Rodney Collins, Mingchu Zhang, Leroy Hulsey, and Xiong Zhang

425Behavior of Strip Footing on Fiber Reinforced Model Slopes

M. Mirzababaei, E. Inibong, M. Mohamed, and M. Miraftab

435<u>Seismic Parametric Study of the FoGuang Geosynthetic Reinforced Slope</u>

Sao-Jeng Chao, Jia-Ruey Chang, Hui-Mi Hsu, and Han-Sheng Liu

444 Analytical Study for Geosynthetic Reinforced Embankment on Elastic Foundation

Wan-Huan Zhou, Lin-Shuang Zhao, and Xi-Bin Li

452Research on the Anchorage-Reinforced Technology in Highway Subgrade Widening Projects

He Wang, Guang-qing Yang, Wei-chao Liu, and Bao-lin Xiong

464A Case Study of MSE Wall Stability: Comparison of Limit Equilibrium and Numerical Methods

Omar A. M. Moudabel, Garry H. Gregory, Xiaoming Yang, and Stephen A. Cross

471 Reinforced Soil Retaining Walls in the Mina Al Fajer Resort Project, Fujairah, UAE

G. Murtaza

481 Influence of Leveling Pad Interface Properties on Soil Reinforcement Loads for Walls on Rigid Foundations

Jianfeng Chen, Yan Yu, and Richard J. Bathurst

493 Numerical Simulations for the Response of MSE Wall-Supported Bridge Abutments to Vertical Loads

Yewei Zheng, Patrick J. Fox, and P. Benson Shing

Geosynthetics for Other Applications

503Analytical and Numerical Studies of Geosynthetic Tubes Resting on Deformable Foundations

Wei Guo, Jian Chu, and Shuwang Yan

515Compensated Raft Foundation on a Preloaded Soil Improved by Vertical Drains

Arindam Dey and Mamidi Anvesh Reddy

526 Numerical Simulation of EPS Geofoam As Compressible Inclusions in Fly Ash Backfill Retaining Walls

B. Ram Rathan Lal, A. H. Padade, and J. N. Mandal

536 Effects of Confinement on the Stress Strain Behavior of EPS Geofoam

Amsalu Birhan and Dawit Negussey

547 Protection of Pipelines and Buried Structures Using EPS Geofoam

Steven F. Bartlett and Bret N. Lingwall

557Behavior Improvement of Raft Foundation on Port-Said Soft Clay Utilizing Geofoam

G. E. Abdelrahman and W. H. El Kamash