Stabilization Of Expansive Soils Using Waste Marble Dust A

Stabilization of expansive soils using lime and cement additives have been used by practitioners over the years. However, recent heaving and premature pavement failures in lime and cement-treated subgrades containing sulfates led to questioning the validity of calciumbased stabilization. When expansive soils containing sulfates are treated with calcium-based stabilizers, the calcium from the stabilizer reacts with soil sulfates and alumina to form the expansive mineral Ettringite. Formation and growth of the mineral Ettringite has been reported as the cause of severe heaving in several pavement failures. Under favorable environmental conditions, Ettringite transforms itself into another expansive mineral, Thaumasite. This heaving is termed as 'sulfate-induced heave' in literature. Several theories have been proposed to understand the heaving mechanisms in sulfate bearing soils. Based on the theoretical background, researchers and practitioners have proposed various methods to treat sulfate soils. Applicability of these methods is mostly limited to soils containing sulfate content less than 8,000 ppm. Soils with sulfate content above 8,000 ppm are termed as 'high sulfate' soils, and chemical treatment of such soils is currently not considered. Hence there exists a research need to create better understanding of the heaving phenomenon in soils with higher sulfate contents and develop practical techniques for stabilizing such soils. This research is designed to aid in

understanding the heaving phenomenon in soils with sulfate contents above 8,000 ppm and to develop practical techniques to stabilize such soils. Six soils: four high plasticity clays, one low-plasticity clay soil and one high-plasticity silt, with sulfate contents varying from 200 ppm - 44,000 ppm, were considered for this research. Chemical and mineralogical tests were performed on the untreated soils to establish the clay mineral distribution and composition of the soils. Additional Gypsum was added to the soils with sulfate contents below 8,000 ppm so they could be considered as 'high sulfate'. These soils were treated with lime and mellowed for periods of zero, three and seven days. Following the mellowing, the samples were remixed, compacted and subjected to various engineering, mineralogical and chemical tests. The present high-sulfate soils were treated lime stabilization with varying mellowing periods and treated soils after treatment were subjected to the engineering and chemical tests. Tests results were analyzed to understand the effectiveness of mellowing period on the heaving phenomenon of 'high sulfate' soils. Both Ettringite formation and crystal growth have contributed significantly to the overall swell of the treated soils. Swell trends observed in the treated soils at respective mellowing periods were attributed to the variability in sulfate levels and reactive alumina and silica contents. Treated soils at higher mellowing periods showed lesser sulfate induced heaving when sulfate levels are lesser than 30,000 ppm. At higher sulfate levels, the mellowing did not result in effective treatment of soils. It was also observed that compaction void ratios and soil clay

mineralogy have a significant impact on the swell behavior of chemically treated high-sulfate soils at different mellowing periods. Hence, mellowing effectiveness is explained using free energy and massvolume approaches. Threshold void ratio framework comprising of natural soil void ratio and sulfate content was developed to predict Ettringite-induced heaving in chemically treated high sulfate soils at different mellowing periods. Another treatment method using lime-fly ash treatment is also studied on two soils and the test results showed that the combined treatment has resulted in lesser soil heaving in these soils. The improvements here are mainly attributed to low amounts of calcium in the combined chemical additive used here. In the final study, the rate of Ettringite formation and growth in the treated soils was indirectly assessed by measuring stiffness properties using the Bender Element tests. Bender Element tests revealed material softening and subsequent stiffness degradation in chemicallytreated high-sulfate soils, and threshold stiffness loss values were established for the treated soils. This non-destructive study assessment can be used to evaluate the Ettringite induced soil heaving in sulfate soils under various chemical treatments.

This volume includes a collection of technical papers on an important topic in geotechnical engineering; the behavior and treatment of expansive soils. The research studies include investigations into novel stabilization techniques for expansive soils using different admixtures or mechanical consolidation techniques, as well as new experimental approaches to evaluate the behavior of

expansive soils. They also include an evaluation of wetting boundary conditions on the volume change of expansive soils, as well as the role of hydrologic boundary conditions in arid climates. The volume is based on the best contributions to the 2nd GeoMEast International Congress and Exhibition on Sustainable Civil Infrastructures, Egypt 2018 – The official international congress of the Soil-Structure Interaction Group in Egypt (SSIGE).

Problematic soils brings together in one volume a collection of papers presented at the Problematic Soils symposium, organised by East Midlands Geotechnical Group of the Institution of Civil Engineers. The papers discuss the behaviour and characteristics of problematic soils (particularly those found in the UK), and they also offer guidance on possible treatment techniques that could be applied for their successful engineering.The proceedings of this symposium are split into three sections.

This book presents the collection of technical papers which includes research on two important topics in geotechnical engineering; the characterization of unsaturated soils. The papers in this collection are representative of local challenges facing geotechnical engineers in the Middle East, but their contributions can also be extended to other regions of the world.

Foundations on Expansive Soils provides the practicing engineer with a summary of the state-of-the-art of expansive soils and practical solutions based on the author's experience. The book is organized into two parts. Part I deals with theory and practice, and

summarizes some of the theoretical physical properties of expansive soils. It also discusses various techniques employed to found structures on expansive soils such as drilled pier foundation, mat foundation, moisture control, soil replacement, and chemical stabilization. Topics covered include the origin, mineralogical composition, and the basic structure of expansive soils; the migration of water, swelling potential, and swelling pressure; site investigations and laboratory testing; moisture control; and soil stabilization. Part II presents case studies on the following: distress caused by pier uplift; distress caused by the improper design and construction of a drilled pier foundation system; distress caused by heaving of footing pad and floor slab; distress caused by heaving of continuous footings; and distress caused by a rise of ground water.

This book presents select proceedings of the International Conference on Advanced Lightweight Materials and Structures (ICALMS) 2020, and discusses the triad of processing, structure, and various properties of lightweight materials. It provides a well-balanced insight into materials science and mechanics of both synthetic and natural composites. The book includes topics such as nano composites for lightweight structures, impact and failure of structures, biomechanics and biomedical engineering, nanotechnology and micro-engineering, tool design and manufacture for producing lightweight components, joining techniques for lightweight structures for similar and dissimilar materials, design for manufacturing, reliability and safety, robotics, automation and control, fatigue and fracture mechanics,

and friction stir welding in lightweight sandwich structures. The book also discusses latest research in composite materials and their applications in the field of aerospace, construction, wind energy, automotive, electronics and so on. Given the range of topics covered, this book can be a useful resource for beginners, researchers and professionals interested in the wide ranging applications of lightweight structures.

Thesis (M.A.) from the year 2016 in the subject Engineering - Civil Engineering, grade: Very Good, , course: Master's Thesis Work, language: English, abstract: Expansive soils are the most problematic soils due to their property of swelling and expansion with the influence of variable moisture, a number of civil engineering structures were destroyed. A billions of US dollars spent worldwide each year to mitigate the problem. The presence of expansive sub-grade soil results pavement distress and damage. Removing the expansive soil and replacing with the competent material is applied to mitigate the problem which is very expensive and time consuming for long hauling distance and thick layer expansive soil. This study presented stabilization of local expansive sub-grade soil using marble waste powder with lime. The marble waste powder was collected in Addis Ababa from Ethiomarble processing enterprise Gulele branch and the lime was collected at Gast Solar Mechanics in Addis Ababa. Free swell index test, Atterberg limit test, Proctor test, unconfined compressive test, California Bearing Ratio Tests, swelling potential and swelling pressure test were used to evaluate properties of treated and untreated

soils. The expansive subgrade soil was treated using 5%, 10%, 15%, 20%, and 25% marble waste powder with fixed 3% lime respective combinations by weight of the soil. The optimum percent combination for this study was 10% marble waste powder with 3%lime based on soaked CBR swell, soaked CBR, swelling pressure and swelling potential test result values. Optimum proportion of stabilizers improve CBR Value from 0.65% to 4.19%, reduce swelling pressure from 1000kpa to 440kpa, increases MDD from 1.21 to 1.29, and reduce PI from 78% to 48.4%. Keywords: marble waste powder, lime, expansive soil, CBR, UCS, swelling pressure, MDD, OMC

This volume comprises the select proceedings of the Indian Geotechnical Conference (IGC) 2020. The contents focus on recent developments in geotechnical engineering for sustainable tomorrow. The volume covers the topics related advances in ground improvement of weak foundation soils for various civil engineering projects and design/construction of reinforced soil structures with different fill materials using synthetic and natural reinforcements in different forms.

This book presents new research studies dealing with the attempts made by the scientists and practitioners to address some key engineering issues in tunneling engineering, geotechnical engineering, and municipal sustainability issues that are becoming quite relevant in today's world. With high urbanization rates, advancement in technologies, difficulties in construction of subway tunnel in soft marine clay deposits, and severe ground subsidence due to excessive groundwater

withdrawal pose many challenges in their management. Papers were selected from the 5th GeoChina International Conference 2018 – Civil Infrastructures Confronting Severe Weathers and Climate Changes: From Failure to Sustainability, held on July 23 to 25, 2018 in HangZhou, China.

This book presents select proceedings of National Conference on Advances in Sustainable Construction Materials (ASCM 2020) and examines a range of durable, energy-efficient, and next-generation construction materials produced from industrial wastes and by-products. The topics covered include sustainable materials and construction, innovations in recycling concrete, green buildings and innovative structures, utilization of waste materials in construction, geopolymer concrete, self-compacting concrete by using industrial waste materials, nanotechnology and sustainability of concrete, environmental sustainability and development, recycling solid wastes as road construction materials, emerging sustainable practices in highway pavements construction, plastic roads, pavement analysis and design, application of geosynthetics for ground improvement, sustainability in offshore geotechnics, green tunnel construction technology and application, ground improvement techniques and municipal solid waste landfill. Given the scope of contents, the book will be useful for researchers and professionals working in the field of civil engineering and especially sustainable structures and green buildings.

This book highlights current research and developments in the area of Structural Engineering and Construction

Management, which are important disciplines in Civil Engineering. It covers the following topics and categories of Structural Engineering. The main chapters/sections of the proceedings are Structural and Solid Mechanics, Construction Materials, Systems and Management, Loading Effects, Construction Safety, Architecture & Architectural Engineering, Coastal Engineering, Foundation engineering, Materials, Sustainability. The content of this book provides necessary knowledge for construction management practices, new tools and technologies on local and global levels in civil engineering which can mitigate the negative effects of built environment.?

The drive to develop more sustainable materials has made fly ash a valuable raw material in many different applications. Comprehensive and authoritative, Handbook of Fly Ash highlights the latest research efforts to develop the properties of fly ash to maximum utility while safeguarding the environment. This book takes an interdisciplinary approach to the research into the classification and compositions of various types of fly ash, such as bottom ash and boiler slag, special classes of fly ash, and their sources around the globe. This is followed by a discussion of fly ash-reinforced composites, such as elastomer-based composites and metal matrix composites. This book also covers a wide range of applications of fly ash in cement, concrete, bricks and blocks, road construction, wastewater treatment, and scrubber sludge solidification. Highlights the recent developments in the utilization of fly ash including its preparation, functionalization, properties,

and handling. Places a focus on a wide variety of fly ash applications including recent innovations, such as alkali-activated binder, polypropylene composite, and geopolymer concrete. Includes comprehensive coverage of the characteristics of fly ash with a particular focus on health hazards if it is not properly disposed. Discusses fly ash-reinforced composites, such as polymer/elastomer-based composites and metal matrix composites.

Expansive clays undergo a large swell when they are subjected to water. Thus, expansive clay is one of the most abundant problems faced in geotechnical engineering applications. It causes heavy damages in structures, especially in water conveyance canals, lined reservoirs, highways, airport runways etc., unless appropriate measures are taken. In this thesis, Granulated Blast Furnace Slag (GBFS), GBFS - Lime combinations and GBFS Cement (GBFSC) were utilized to overcome or to limit the expansion of an artificially prepared expansive soil sample (Sample A). GBFS and GBFSC were added to Sample A in proportions of 5 to 25 percent. Different GBFS-Lime combinations were added to Sample A by keeping the total addition at 15 percent. Effect of stabilizers on grain size distribution, Atterberg limits, swelling percentage and rate of swell of soil samples were determined. Effect of curing on swelling percentage and rate of swell of soil samples were also determined. Leachate analysis of GBFS, GBFSC and samples stabilized by 25 percent GBFS and GBFSC was performed. Use of stabilizers successfully decreased the amount of swell while increasing the rate

of swell. Curing samples for 7 and 28 days resulted in less swell percentages and higher rate of swell. Expansive soils are a worldwide problem that poses several challenges for civil engineers. Such soils swell when given an access to water and shrink when they dry out. The most common and economical method for stabilizing these soils is using admixtures that prevent volume changes. In this study the effect of using rock powder and aggregate waste with lime in reducing the swelling potential is examined. The expansive soil used in this study is prepared in the laboratory by mixturing kaolinite and bentonite. Lime was added to the soil at 0 to 9 percent by weight. Aggregate waste and rock powder were added to the soil at 0 to 25 percent by weight. Grain size distribution, Atterberg limits and swell percent and rate of swell of the mixtures were determined. Specimens were cured for 7 and 28 days. This method of treatment caused a reduction in the swelling potential and the reduction was increased with increasing percent stabilizers.

This book presents the select proceedings of the International Conference on Sustainable Practices and Innovations in Civil Engineering (SPICE 2019). The chapters discuss emerging and current research in sustainability in different areas of civil engineering, which aim to provide solutions to sustainable development. The contents are broadly divided into the following six categories: (i) structural systems, (ii) environment and water resource systems, (iii) construction technologies, (iv)geotechnical systems, (v) innovative building materials, and (vi) transportation. This book will be of potential interest for students, researchers, and practitioners working in sustainable civil engineering related fields.

Expansive soils are one of the most serious problems which the foundation engineer faces. Several attempts are being made to control the swell-shrink behavior of these soils. One of the most effective and economical methods is to use chemical additives. Fly ash and desulphogypsum, both of which are by-products of coal burning thermal power plants, are accumulating in large quantities all over the world and pose serious environmental problems. In this study, the expansive soil was stabilized using the fly ash and desulphogypsum obtained from Çayýrhan Thermal Power Plant. Fly ash and desulphogypsum were added to the expansive soil from 0 to 30 percent. Lime was used to see how efficient fly ash and desulphogypsum on expansive soil stabilization were, and was added to the expansive soil from 0 to 8 percent. The properties obtained were chemical composition, grain size distribution, consistency limits, swelling percentage, and rate of swell. Fly ash, desulphogypsum, and lime added samples were cured for 7 days and 28 days, after which they were subjected to free swell tests. Swelling percentage decreased and rate of swell increased with increasing stabilizer percentage. Curing resulted in further reduction in swelling percentage and further increase in rate of swell. 25 percent and 30 percent fly ash and desulphogypsum additions reduced the swelling percentage to levels comparable to lime stabilization.

This volume presents selected papers presented during the 4th International Conference on Transportation Geotechnics. The papers address the geotechnical challenges in design, construction, maintenance, monitoring, and upgrading of roads, railways, airfields, and harbor facilities and other ground transportation infrastructure with the goal of providing safe, economic, environmental, reliable and sustainable infrastructures. This volume will be of interest to postgraduate students, academics, researchers, and consultants working in

the field of civil and transport infrastructure.
This volume presents select papers presented at the 7th International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics. The papers discuss advances in the fields of soil dynamics and geotechnical earthquake engineering. A strong emphasis is placed on connecting academic research and field practice, with many examples, case studies, best practices, and discussions on performance based design. This volume will be of interest to researchers and practicing engineers alike.
Many approaches have been undertaken to mitigate global climate change, including the movement away from fossil fuels. Fossil Free Fuels: Trends in Renewable Energy examines several key topics, such as the utilization of biofuels as a sustainable renewable resource, recycling and untapped waste-to-energy products, and other carbon-neutral strategies in various industries, such as the transportation, construction, and manufacturing sectors. It provides recent updates on the latest technologies, modeling, design, and technical aspects, as well as several practical case studies. The current world energy scenario is examined and various solutions to larger environmental problems are outlined in terms of the shift to more alternative energy sources. Features: Minimizes technical jargon in a straightforward style for a wider audience Discusses sustainable options for different industries, such as the use of green materials in the construction sector, biofuels for transportation, and many more Includes numerous illustrations, tables, and figures to aid in understanding This book serves as a practical reference for engineers, researchers, environmental consultants working in renewable energy industries, and students.
Effective measurement of the composition and properties of petroleum is essential for its exploration, production, and

refining; however, new technologies and methodologies are not adequately documented in much of the current literature. Analytical Methods in Petroleum Upstream Applications explores advances in the analytical methods and instrumentation that allow more accurate determination of the components, classes of compounds, properties, and features of petroleum and its fractions. Recognized experts explore a host of topics, including: A petroleum molecular composition continuity model as a context for other analytical measurements A modern modular sampling system for use in the lab or the process area to collect and control samples for subsequent analysis The importance of oil-in-water measurements and monitoring The chemical and physical properties of heavy oils, their fractions, and products from their upgrading Analytical measurements using gas chromatography and nuclear magnetic resonance (NMR) applications Asphaltene and heavy ends analysis Chemometrics and modeling approaches for understanding petroleum composition and properties to improve upstream, midstream, and downstream operations Due to the renaissance of gas and oil production in North America, interest has grown in analytical methods for a wide range of applications. The understanding provided in this text is designed to help chemists, geologists, and chemical and petroleum engineers make more accurate estimates of the crude value to specific refinery configurations, providing insight into optimum development and extraction schemes. Sustainable and Nonconventional Construction Materials Using Inorganic Bonded Fiber Composites presents a concise overview of non-conventional construction materials with a strong focus on alternative inorganic bonded fiber composites and their applications as construction components. It outlines the processing and characterization of non-conventional cementitious composites, which will be of great benefit to both

academic and industrial professionals interested in research, development, and innovation on inorganic bonded fiber composites. The book gives a comprehensive review of the innovative research associated with building components based on inorganic bonded composites. Exploring both natural fibers as reinforcing elements and alternative inorganic binders based on agricultural and industrial wastes, this book also considers the performance and applications of fibrous composites as construction materials and components. Dedicated to analyzing recent developments in inorganic fiber composites research Discusses the broader subjects of processing, characterization, performance, and applications of non-conventional construction materials

This book contains the contributions to the Second European Conference on Unsaturated Soils, E-UNSAT 2012, held in Napoli, Italy, in June 2012, and includes more than one hundred papers, addressing three thematic areas: experimental, modelling, and engineering.

This book gathers selected papers presented at the 8th International Congress on Environmental Geotechnics (ICEG), held on October 28 - November 1, 2018 in Hangzhou, China. The theme of the congress is “Towards a Sustainable Geoenvironment”, which means meeting the needs of the present generation without compromising the ability of future generations to meet their own needs. Under this theme, the congress covers a broad range of topics and provides an excellent opportunity for academics, engineers, scientists, government officials, regulators, and planners to present, discuss

and exchange notes on the latest advances and developments in the research and application of environmental geotechnics.

Modification of black cotton soils by chemical admixtures is a common method for stabilizing the swell-shrink tendency of expansive soils. Advantages of chemical stabilization are that they reduce the swell-shrink tendency of the expansive soils and also render the soils less plastic. Among the chemical stabilization methods for expansive soils, lime stabilization is most widely adopted method for improving the swell-shrink characteristics of expansive soils. Lime stabilization of clays in field is achieved by shallow mixing of lime and soil or by deep stabilization technique. Shallow stabilization involves scarifying the soil to the required depth and lime in powder or slurry form is spread and mixed with the soil using a rotovator. The use of lime as deep stabilizer has been mainly restricted to improve the engineering behaviour of soft clays Deep stabilization using lime can be divided in three main groups: lime columns, lime piles and lime slurry injection. Lime columns refer to creation of deep vertical columns of lime stabilized material. Lime piles are usually holes in the ground filled with lime. Lime slurry pressure injection, as the name suggests, involves the introduction of a lime slurry into the ground under pressure. Literature review brings out that lime stabilization of expansive clays in

field is mainly performed by mixing of lime and soil up to shallow depths. The use of lime as deep stabilizer has been mainly restricted to improve the engineering behaviour of soft clays. Use of lime in deep stabilization of expansive soils however has not been given due attention. There exists a definite need to examine methods for deep stabilization of expansive soils to prevent the deeper soil layers from causing distress to the structures in response to the seasonal climatic variations. In addition, there exists a need for in-situ soil stabilization using lime in case of distressed structures founded on expansive soil deposits. The physical mixing of lime and s. This paper investigates the effectiveness of using cement by-pass dust, copper slag, granulated blast furnace slag, and slag-cement in reducing the swelling potential and plasticity of expansive soils. The soil used in this study was brought from Al-Khod (a town located in Northern Oman) where structural damage was observed. The first stage of the experimental program dealt with the determination of the chemical, mineralogical, and geotechnical characteristics of the untreated soil. The soil was then mixed with the stabilizers at 3, 6, and 9% of the dry weight of the soil. The treated samples were subjected to liquid limit, plastic limit, swell percent, and swell pressure tests. Furthermore, the cation exchange capacity, exchangeable cations (Na+, Ca++, Mg++, and K+), and pH of the treated

samples were also measured. The study showed that copper slag caused a significant increase in the swelling potential of the treated samples. Other stabilizers reduced the swelling potential and plasticity at varying degrees. The study further indicated that cation exchange capacity and the amount of sodium and calcium cations are good indicators of the effectiveness of chemical stabilizers used in soil stabilization.

Stabilization of Local Expansive Subgrade Soil using Marble waste powder with LimeGRIN Verlag

Essential technical information for building on expansive soils--complete with practical, proven design methods. Expansive Soils examines factors that influence the design offoundations and pavements built on expansive soils, and exploreskey design procedures and remedial measures that address thesefactors effectively. Backed by the authors' extensive research andexperience --including interviews with practicing engineers workingwith expansive soils --this authoritative volume is an importantreference text for geotechnical and foundation engineers,geologists, construction professionals, and students. Easy to understand and apply, Expansive Soils contains: * Site investigation techniques for identification andclassification of expansive soils * Heave prediction methods using different types of data --withrigorous treatment of soil suction theory and

measurement,oedometer tests, and more * Alternative design procedures for drilled pier and slab-on-gradefoundations, highway and airfield pavements * Treatment and chemical stabilization techniques --including salttreatment; moisture barriers; lime and cement stabilization; andother procedures * Remedial measures such as drainage control, and removal withreplacement and compaction control * Sample problems illustrating practical applications.

This volume contains selected papers presented during the International Conference on Environmental Geotechnology, Recycled Waste Material and Sustainable Engineering (EGRWSE-2018). The papers focus on finding innovative ways of recycling and reusing waste materials, reducing demand for natural resources and processing industrial and chemical wastes such that disposal reduces their environmental burden. This volume will be of interest to researchers, policy makers and practitioners working in the field of waste management.

A comprehensive guide for both fundamentals and real-world applications of environmental engineering Written by noted experts, Handbook of Environmental Engineering offers a comprehensive guide to environmental engineers who desire to contribute to mitigating problems, such as flooding, caused by extreme weather events, protecting populations in

coastal areas threatened by rising sea levels, reducing illnesses caused by polluted air, soil, and water from improperly regulated industrial and transportation activities, promoting the safety of the food supply. Contributors not only cover such timely environmental topics related to soils, water, and air, minimizing pollution created by industrial plants and processes, and managing wastewater, hazardous, solid, and other industrial wastes, but also treat such vital topics as porous pavement design, aerosol measurements, noise pollution control, and industrial waste auditing. This important handbook: Enables environmental engineers to treat problems in systematic ways Discusses climate issues in ways useful for environmental engineers Covers up-to-date measurement techniques important in environmental engineering Reviews current developments in environmental law for environmental engineers Includes information on water quality and wastewater engineering Informs environmental engineers about methods of dealing with industrial and municipal waste, including hazardous waste Designed for use by practitioners, students, and researchers, Handbook of Environmental Engineering contains the most recent information to enable a clear understanding of major environmental issues.

The articles presented in this book deal with the attempts made by the scientists and practitioners to address contemporary issues in geoenvironmental engineering such as characterization of dredged sediments, geomaterials & waste, valorization of waste, sustainability in waste management, and some other

geoenvironmental issues that are becoming quite relevant in today's world. With high urbanization rates, advancement in technologies, and changes in consumption behavior of people, wastes generated through the daily activities of individuals and organizations pose many challenges in their management.

Extended Abstracts of Research Papers Published in 5IYGEC: The 5th Indian Young Geotechnical Engineers Conference, organized by Indian Geotechnical Society to commemorate Silver Jubilee of IGS, Baroda Chapter.

Expansive Soils provides the reader with easy and specific access to problems associated with expansive soils, characterisitics and treatment, and evaluation and remediation. Set up with contributions from worlwide expert, this main reference guide is intended for engineers, researchers and senior students working on soil

This volume includes a collection of technical papers covering two important research topics in geotechnical engineering: (1) the behavior and treatment of expansive soils, and (2) the characterization of rock properties. The twelve studies on expansive soils include investigations into novel stabilization techniques for expansive soils using different admixtures or mechanical consolidation techniques, as well as new experimental approaches to evaluate the behavior of expansive soils. They also include an evaluation of wetting boundary conditions on the volume change of expansive soils, as well as the role of hydrologic boundary conditions in arid climates. The four studies on rock properties include thermo-hydro-

mechanical behavior of gypsum rock, role of rock strength in blastability, indirect methods to estimate rock strength, and variations in isotope distributions in Permian rocks. The two broad themes in this collection, as summarized above, are representative of local challenges facing geotechnical engineers in the Middle East, but their contributions can also be extended to other regions of the world. This volume is part of the proceedings of the 1st GeoMEast International Congress and Exhibition on Sustainable Civil Infrastructures, Egypt 2017.

This book presents 09 keynote and invited lectures and 177 technical papers from the 4th International Conference on Geotechnics for Sustainable Infrastructure Development, held on 28-29 Nov 2019 in Hanoi, Vietnam. The papers come from 35 countries of the five different continents, and are grouped in six conference themes: 1) Deep Foundations; 2) Tunnelling and Underground Spaces; 3) Ground Improvement; 4) Landslide and Erosion; 5) Geotechnical Modelling and Monitoring; and 6) Coastal Foundation Engineering. The keynote lectures are devoted by Prof. Harry Poulos (Australia), Prof. Adam Bezuijen (Belgium), Prof. Delwyn Fredlund (Canada), Prof. Lidija Zdravkovic (UK), Prof. Masaki Kitazume (Japan), and Prof. Mark Randolph (Australia). Four invited lectures are given by Prof. Charles Ng, ISSMGE President, Prof.Eun Chul Shin, ISSMGE Vice-President for Asia, Prof. Norikazu Shimizu (Japan), and Dr.Kenji Mori (Japan).