Hosted by the Korean Geotechnical Society – North America (KGS-NA)

2nd US-Korea Geotech Workshop

UNIVERSITY OF NEBRASKA–LINCOLN

OCTOBER 22-23, 2020

WORKSHOP REGISTRATION

You are invited to a Zoom webinar.

Oct 22, 2020 | 07:00 PM Central Time (US and Canada)
Oct 23, 2020 | 09:00 AM (GMT+9) (Korea)

2nd US-Korea Geotech Workshop

Register in advance for this webinar:
https://unl.zoom.us/webinar/register/WN_KHC2O9IAT2K7gsw2DDE4OQ

COLLEGE OF ENGINEERING

KOREAN GEOTECHNICAL SOCIETY

WELCOME

Dear KGS-NA 2020 Workshop participants,

It is my great pleasure to welcome all of you to the 2nd US-Korea Geotech Workshop hosted by the Korean Geotechnical Society – North America (KGS-NA). Due to the COVID-19 pandemic, this year's event, originally scheduled to take place in University of Nebraska–Lincoln, will be conducted as a virtual event in October 2020.

Although this workshop is the part of KGS-NA members' effort to facilitate co-works between Korea-based Geotechnical scholars/engineers and US-based Geotechnical scholars/engineers, attendees will be able to join from anywhere in the world, experience presentation, and most importantly, connect with other attendees through an interactive virtual event platform in this year.

The meeting program covers emerging geotechnical and geoenvironmental engineering issues, addressing topics of interest to policy makers, administrators, practitioners, researchers, technical experts, and representatives of government, industry, and academic institutions.

The organizing committee is extremely delighted to invite everyone to this exciting workshop. Lastly, the organizing committee would like to express our sincere appreciation to KGS headquarters and sponsors, all committee members, and volunteers who made this conference possible.

Sung-Hee (Sonny) Kim, Ph.D., P.E., F.ASCE
President, KGS-NA

AGENDA

7:00 PM (US CDT)

WELCOME

Dr. Sung-Hee (Sonny) Kim, University of Georgia, USA

CONGRATULATORY REMARKS

Dr. Choong-Ki Chung, Seoul National University

PROGRAM I

MODERATOR: Dr. Jongwan Eun, Assistant Professor, Department of Civil and Environmental Engineering, University of Nebraska–Lincoln

7:15 PM	**(1)** *Biopolymer-based soil treatment (BST) for sustainable geotechnical engineering and to combat global climate change* Dr. Ilhan Chang, Associate Professor, Department of Civil System Engineering, Ajou University
7:30 PM	**(2)** *Real-time prediction of penetration rate of shield TBM based on machine learning* Dr. Ki Il Song, Professor, Department of Civil Engineering, College of Engineering, Inha University
7:45 PM	**(3)** *Smart materials and energy geotechnology* Dr. Jongwon Jung, Associate Professor, Chungbuk National University
8:00 PM	**(4)** *Underground measurement and interpretation of underground cavity and growth* Dr. Heejung Youn, Associate professor, Department of Civil Engineering, Hongik University
8:15 PM	**(5)** *Toward microbial soil improvement: Impact of soft viscoelastic bacterial biopolymers on soil behavior* Dr. Tae-Hyuk Kwon, Associate Professor, Korea Advanced Institute of Science and Technology (KAIST)
8:30 PM	**(6)** *Geophysical Site Characterization: Advances in Invasive and Noninvasive Survey Methods* Dr. Taeseo Ku, Department of Civil & Environmental Engineering, National University of Singapore (NUS)
8:45 PM (US CDT)	BREAK

PROGRAM II

MODERATOR: Dr. Boo Hyun Nam, Associate Professor, Department of Civil, Environmental, and Construction Engineering (CECE), Director of Florida Sinkhole Research Laboratory (FSRL), University of Central Florida (UCF)

9:00 PM	**(7)** *Phase-field formulations for simulation of fractures and discontinuities in geologic materials using the standard finite element method* Dr. Jinhyun Choo, Assistant Professor, Department of Civil Engineering, The University of Hong Kong (HKU)
9:15 PM	**(8)** *Piezocone/Cone Penetration Test-Based Pile Capacity Analysis: Calibration, Evaluation, and Implication of Geological Conditions* Dr. Chung R. Song, Associate Professor, Department of Civil and Environmental Engineering, University of Nebraska-Lincoln
9:30 PM	**(9)** *NDT approaches in transportation geotechnics* Dr. Sung-Hee (Sonny) Kim, Associate Professor, Civil and Environmental Engineering, University of Georgia
9:45 PM	**(10)** *Sinkhole vulnerability evaluation using Cone Penetration Testing (CPT): Central Florida case study* Dr. Boo Hyun Nam, Associate Professor, Department of Civil, Environmental, and Construction Engineering (CECE), Director of Florida Sinkhole Research Laboratory (FSRL), University of Central Florida (UCF)
10:00 PM	**(11)** *Current status of design and construction of piles with a pilot hole* Dr. Soonkie Nam, Assistant Professor, Department of Civil Engineering and Construction, Georgia Southern University
10:15 PM	**(12)** *Effect of water retention properties for municipal solid waste on landfill stability* Dr. Jongwan Eun, Assistant Professor, Department of Civil and Environmental Engineering, University of Nebraska-Lincoln
10:30 PM	**(13)** *Pipe-pile-based micro-scale compressed air energy storage (PPMS-CAES) for a building* Dr. Seunghee Kim, Assistant Professor, Department of Civil and Environmental Engineering, University of Nebraska-Lincoln
10:45 PM (US CDT)	ADJOURN

WORKSHOP SESSIONS

Biopolymer-based soil treatment (BST) for sustainable geotechnical engineering and to combat global climate change

Dr. Ilhan Chang, Associate Professor, Department of Civil System Engineering, Ajou University

Abstract: In recent years, a number of environmental challenges, including global warming and desertification, have risen to the forefront of human focus and attention. The soil of the earth has been the basis of human life and prosperity throughout the ages in all countries around the world; however, the confluence of global climate change and the accompanying land degradation is now contributing to a variety of socio-economic problems, such as the loss of farmland, air pollution (fine dust), severe famines (e.g., in Africa), water shortages, and so on. In this context, geotechnical engineers are responsible to preserve the land on planet Earth. In addition, geotechnical engineering also have the responsibility to identify and prepare extra-planetary territory as an alternative to earth to ensure human survival in an extreme future scenario. Recent advances in the fields of geotechnical engineering and biotechnology are combined in an environmentally-friendly approach to soil treatment and preservation. Specifically, microbial biopolymers have been adapted as novel soil binders are discussed in terms of how they function to enhance inter-particle interactions in soils and facilitate plant growth with minimal environmental impact in terms of their CO2 emissions and groundwater disturbance. Numbers of research have been performed to investigate the bio-chemical interactions between biopolymers and soil with the objective of increasing their binding strength, and the optimal conditions for biopolymer treatment were explored while considering different types of biopolymers and soils. Today, bio-soil technologies have been attempted in a number of applications, including cement-free pavement, slope and embankment stabilization, aeolian erosion reduction, and in-situ ground improvement practices.

Bio: Dr. Ilhan Chang is an Associate Professor in the Department of Civil System Engineering at Ajou Universtiy. Dr. Chang has comprehensive expertise in geotechnical engineering, multi-disciplinary studies, industrial cooperation and commercialization. Prior to his current appointment to Ajou University, Dr. Chang engaged his professional career as a Senior Lecturer (April 2017~August 2020) at the University of New South Wales (UNSW) Australia, and as a Senior Researcher (January 2012~February 2017) at the Korea Institute of Civil Engineering and Building Technology (KICT). Dr. Chang earned his Bachelor of Science (2000), Master of Engineering (2004), and Doctor of Philosophy (2010) degrees in Civil and Geotechnical Engineering at KAIST (Korea Advanced Institute of Science and Technology). Main topics of his M.S. and Ph.D. dissertations were “Soft Soil Evaluation using Elastic Waves” and “Soil Stabilization using Microbial Biopolymers”, respectively. Currently, Dr. Chang is leading the E3 Geotechnical Engineering Research Group (E3GEO) at Ajou University and UNSW. Up-to-date, Dr. Chang published 35 international SCI(E) journal papers, 62 international conference papers, and 11 registered patents (1 USA, 10 Korea) from his research career.

Real-time prediction of penetration rate of shield TBM based on machine learning

Dr. Ki Il Song, Professor, Department of Civil Engineering, College of Engineering, Inha University

Abstract: Shield TBM machine parameters are determined considering ground conditions and can be affected by operator's skills and their habits. To predict the penetration rate (PR) in real-time considering the shield TBM machine parameter, a dynamic model is proposed in this study. Proposed model builds the new model by reflecting the operating conditions and ground conditions in real time. ARIMAX used to predict the machine parameters and GBRT is used to predict the PR. The ARIMAX & GBRT dynamic models were applied to cable tunnel projects and it is found that the prediction performance improved compared to traditional PR prediction method. The proposed dynamic model can reasonably suggest the optimal machine parameter ahead the tunnel face for operator.

Bio: Dr. Ki Il Song is professor in department of civil engineering at the Inha University, South Korea. He completed his Ph.D. in geotechnical engineering at the Korea Advanced Institute of Science and Technology (KAIST) 2009. The title of his Ph.D. dissertation was "Evaluation and analysis methods for key elements affecting tunnel behavior – spatial variability, shotcrete bonding state, pre-reinforcement". Dr. Song has been involved in many national scientific research projects related to tunnelling. He has a strong background of numerical analysis and computational geomechanics. The finite element programming and genetic algorithm-based optimization by using a Visual Studio Developer that can design a pipe-roof pre-reinforcement system ahead of the tunnel face is supported by the Korean Advanced Institute of Science and Technology (KAIST) and Samsung. Dr. Song also has a fundamental knowledge on the nondestructive characterization techniques that use elastic wave and electromagnetic wave propagation for the sustainable geotechnical development. His main research topics are 1) Use of machine learning for geotechnical engineering problem 2) Automation of tunnel support design for underground structure 3) Geophysical characterization for engineered geo-materials 4) Non-destructive evaluation for geo-infrastructures 5) Mechanized Tunnel (cutter head design, segment design, back-fill evaluation, penetration performance,
large-diameter TBM, etc.).

Smart materials and energy geotechnology

**Dr. Jongwon Jung, Associate Professor,
Chungbuk National University**

Abstract: In geotechnical engineering, our interesting topics are 'how we can improve soil properties' 'how multiphase fluids flow influences on the soil properties'. Thus, we have developed smart materials such as biopolymers, gypsum, and ashes in order to improve soil properties. Also, multiphase fluids flow are related to soil improvement method by the injection of polymer solution into soils, which has been studied. Our research started from micro-scaled experiments using micromodel, SEM, and XRD equipment, and moved to intermediate scaled experiments such as soil-water characteristic curve test, uniaxial strength tests, bonding tests, and triaxial tests. Based on multi-scaled experimental results, we conducted the numerical simulation to clarify the effects of smart materials on the geotechnical structures. The results will help us decide the injection techniques for soil improvement.

Bio: Dr. Jongwon Jung received his B.S. and M.S. from Korea University and Ph.D. in Civil and Environmental Engineering from Georgia Tech. His graduate study focused on the advance of tunneling system design considering seepage force (M.S.) and the gas production from hydrate bearing sediments (Ph.D.). He conducted his research on the topic 'geological CO2 sequestration as a postdoctoral fellow at Lawrence Berkeley National Laboratory. After joining LSU at 2012 as an assistant professor, he had continued these topics and conducted new topic 'soil improvement using biopolymers and recycled materials'. And then, after he moved to Chnugbuk National University in South Korea at 2017, he has continued these research topics.

Underground measurement and interpretation of underground cavity and growth

**Dr. Heejung Youn, Associate Professor, Department of Civil Engineering,
Hongik University**

Abstract: Human activities often created underground cavity and it's growth to ground surface. Man-made underground pipeline is one of the causes of such cavity growth and subsequent ground subsidence. Field test data for such subsidence is normally unattainable because the collapse time and location are not estimable. Thus, most ground subsidence problem was approached by either numerical simulations or small scale laboratory test. In this study, large scale field test was performed to mimic underground cavity by embedded damaged pipe. Different relative density, rainfall intensity was introduced, and the variations of earth pressure, water content, and displacement were measured until the ground subsidence occurred. Although the cavity growth passage is not predictable, the cavity growth was detected by earth pressure gauges. Also, it was found that the ground subsidence is not likely to occur when the relative density of ground is greater than 85%.

Bio: Dr. Heejung Youn is an associate professor of Civil Engineering at the Hongik University. He received his B.S. from Seoul National University in 2002, M.S. from University of Idaho in 2005, and Ph.D. from the University of Texas at Austin in 2008. He joined the Korea Institute of Ocean Science & Technology for 1.5 years as research associate before he joined the Hongik University in 2010. During his academic career at the university, his main research interests were the offshore foundation for wind turbine, ground improvement using Microbially induced calcite precipitation technique, and Coupled Eulerian Lagrangian analysis on the ground subsidence by underground cavity. Currently, he is focusing on the development of sinkhole detection system using artificial intelligence. Some small projects he has been involved in include the underground waterproofing system, soil nailing, offshore anchor, numerical simulation of blasting near tunnel. He has published over 40 peer-reviewed journal papers, and many conference papers.

Toward microbial soil improvement: Impact of soft viscoelastic bacterial biopolymers on soil behavior

Dr. Tae-Hyuk Kwon, Associate Professor,
Korea Advanced Institute of Science and Technology (KAIST)

Abstract: Use of soft viscoelastic biomaterials, including bacterial biofilms and biopolymers, are considered in a variety of geotechnical practices, as such soft bio-materials can alter hydro-mechanical responses of geo-materials. These soft bio-materials have garnered significant interest as an alternative to the chemical grouts for their biodegradability, ecological suitability and low toxicity. In this talk, two topics will be presented. First, I will talk about the effect of bacterial biopolymers on soil properties, including hydraulic conductivity, erosion resistance, and high-frequency seismic responses. Meanwhile, saturated loose sands are prone to contractive failures associated with excess pore pressure generated by undrained loading. In the second part of this talk, the undrained load-deformation behavior of contractive sands treated with a soft viscoelastic biopolymer, gelatin will be presented. The results reveal that the inclusion of a soft viscoelastic biopolymer restrains the contractive behavior associated with post-peak softening but increases the undrained shear strength of contractive loose sands.

Bio: Tae-Hyuk Kwon currently works as an associate professor in Department of Civil and Environmental Engineering at Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea. He received his BSc (2002) followed by an MS (2004) and PhD (2008) at KAIST. During his PhD, he spent one year working as a visiting scholar at Georgia Tech (2005). From 2009 to 2011 he was a postdoctoral fellow at the Earth Sciences Division at Lawrence Berkeley National Laboratory (LBNL). From 2011 to 2013, he worked as a tenure-track assistant professor in the Department of Civil and Environmental Engineering at Washington State University, Pullman, WA, U.S.A. Since 2013, he is leading a research group at KAIST, first as an assistant professor (2013–2018) and now as an associate professor since 2018. He leads the Geo-Energy LAboratory (GELA). Tae-Hyuk's research interest is in understanding of alterations in subsurface properties of relevance to the environmental and energy processes. His technological focus in the field is on understanding of bio-chemo-thermo-hydro-mechanical processes in subsurface environments through multi-scale experimentation and modeling. He is active in several research projects related to production of natural gas hydrates, microbial enhanced oil recovery, biological soil improvement, rainfall-induced landslide prediction and mitigation, and hydraulic fracturing. At a small length scale, he has a research program examining the bio-chemical processes in porous media at the pore- to core-scale using microfluidic chips and X-ray computed microtomography. At a bigger length scale, he also leads the projects related to remote sensing using drone-LiDAR system and satellite-SAR images for landslide analysis and detection, underground tunneling using TBM, and non-destructive monitoring in geologic high-level nuclear waste disposal. He is affiliated as a chair-nominated member of TC104 physical modelling in geotechnics, a nominated member of TC306 geo-education, and a corresponding member of TC308 energy geotechnics of International Society of Soil Mechanics and Geotechnical Engineering (ISSMGE). He currently serves as an editorial board member for two international scientific journals, Environmental Geotechnics and International Journal of Geo-Engineering.

Geophysical Site Characterization: Advances in Invasive and Noninvasive Survey Methods

Dr. Taeseo Ku, Department of Civil & Environmental Engineering, National University of Singapore (NUS)

Abstract: As natural geomaterials and geologic formations commonly involve the inherent variability and complexities, the characterization of subsurface conditions is one of the most challenging yet important activities required for the successful planning, design, construction, and operation of civil infrastructure as well as for any geotechnical project. In this talk, some outstanding case studies of advanced seismic wave-based geo-characterization are introduced: (1) A new exploratory procedure for collecting continuous shear wave velocity (VS) measurements via cone penetration testing using a special autoseis source is presented whereby wavelets can be generated and recorded every 1 to 10s. The continuous-interval seismic piezocone test offers a fast, productive, and reliable means to expedite the collection of downhole VS profiles, as well as additional CPT readings with depth. (2) The application of seismic cross-hole tomography for site investigation is advantageous as it can be used to supplement traditional methods for effective site characterization. It allows very efficient and complete 2-D scanning of subsurface. A recent case study on a reclaimed land in Singapore will be introduced. (3) Underground mapping via non-invasive surface wave based geophysical methods is briefly presented. Crosscorrelation seismic interferometry, a new and advanced surface wave method, is introduced as an attractive passive geophysical survey that can be effectively used in urban environments.

Bio: Dr. Taeseo Ku is currently an assistant professor in the Department of Civil and Environmental Engineering at the National University of Singapore (NUS). Prior to joining NUS, Dr Ku was a postdoctoral research fellow at Georgia Institute of Technology where he received his PhD degree. He was a member of GT in-situ testing group in GeoSystems Division and worked on several projects for the US Department of Energy and ConeTec Investigations, Inc. He is currently a nominated member for TC 101 (Laboratory Stress Strength Testing of Geomaterials) and TC 102 (Ground Property Characterization from In-Situ Tests), ISSMGE. His primary research interests are on the related areas of in-situ geotechnics and geophysical site investigations. Especially, a focused research area centers on the measurement, evaluation, and application of seismic waves (e.g., shear wave velocity and the related small-strain stiffness in soils), with a particular interest in advanced geotechnical and geophysical site characterization (i.e., innovative wave-based geo-characterization). Recently, his research group has also conducted a ground/soil improvement study that involves the application of a new cement agent (e.g., environmentally eco-friendly material) as well as a new mixing design concept of binary mixtures (e.g., sandy clay, clayey sand).

Phase-field formulations for simulation of fractures and discontinuities in geologic materials using the standard finite element method

Dr. Jinhyun Choo, Assistant Professor, Department of Civil Engineering,
The University of Hong Kong (HKU)

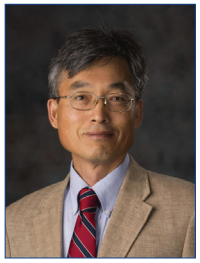
Abstract: Geologic fractures and discontinuities (e.g. slip surfaces, joints, and faults) play a critical role in a wide variety of engineering problems. Examples range from landslides and progressive failures in shallow geotechnical systems, to hydraulic fracturing, geologic CO2 sequestration, and induced seismicity in deep subsurface systems. Numerical analysis is commonly employed to address these problems. However, it remains as a formidable challenge to simulate geologic fractures and discontinuities, particularly when they propagate. Most existing approaches to simulating fracture propagation require complex algorithms that are incompatible with standard numerical methods used in practice. This talk will introduce a recently emerged approach — phase-field modeling — which enables simulation of propagating fractures using any standard numerical methods including the finite element method. A particular focus will be on new phase-field models that, for the first time, incorporate unique features in geologic fractures and discontinuities: friction along the crack, pressure dependence, and mixed-mode cracking. It will be thoroughly demonstrated that the new phase-field models simulate fracturing processes in geomaterials accurately, in both quantitative and qualitative senses, without any special discretization method.

Bio: Dr. Jinhyun Choo is an Assistant Professor of Civil Engineering at The University of Hong Kong (HKU). He received his Ph.D. from Stanford University, as a Fulbright Scholar, in Civil and Environmental Engineering with a minor in Mechanical Engineering. He then completed a year of postdoctoral training at Columbia University before joining the HKU faculty. He is currently a member of the Computational Geotechnics, Computational Mechanics, and Poromechanics committees of ASCE, and the Numerical Methods, Geomechanics, and Energy Geotechnics committees of ISSMGE. Dr. Choo's research focuses on the understanding, prediction, and management of the performance of subsurface systems under complex structural and environmental loads. To this end, he seeks to improve and integrate physics-based modeling, high fidelity simulation, and data analytics of soil and rock deformations and their interactions with fluid flow, chemical reactions, and temperature changes. His work is applied to a wide range of geotechnical problems that relate to infrastructure resilience, energy resources, and environmental sustainability.

Piezocone/Cone Penetration Test-Based Pile Capacity Analysis: Calibration, Evaluation, and Implication of Geological Conditions

Chung R. Song, Associate Professor, Department of Civil and Environmental Engineering, University of Nebraska-Lincoln

Abstract: Several studies have proposed evaluation schemes to assess the performance of cone/piezocone penetration test (CPT/PCPT)-based pile analyses. However, approaches that calibrate, evaluate and consider the locality of these methods are not fully recognized, yet. In this study, a calibration method using a least square analysis and subsequent evaluation of CPT/PCPT-based methods was conducted based on a pile and CPT/PCPT database. The evaluation scheme comprised different statistical criteria and a ranking index (RI) was used to evaluate the methods. After the evaluation, De Ruiter and Beringen (1979), Tumay and Fakhroo (1982) and Clisby et al. (1978) showed a fair performance for H-piles with overall RI of 8, 9, and 13, respectively. De Ruiter and Beringen (1979), Eslami and Fellenius (1997), and Bustamante and Gianeselli (1982) showed a fair performance for closed-ended pipe and prestressed concrete piles with overall RI 9, 14, and 15 respectively. In addition, consideration of the geological conditions for the better performing techniques showed that they were commonly developed for soils mostly derived from marine deposit during Mesozoic era and melting of thick ice sheet during Cenozoic era. Consideration of prevailing geological condition for the test sites, therefore, is recommended in predicting pile bearing capacity based on CPT/PCPT-based.



Bio: Dr. Chung R. Song has over 30 years of academic and professional experience in geotechnical engineering. He obtained BS from Yonsei University and MSc degree from The University of Texas at Austin, with an emphasis on Geotextiles and Soil Dynamics, respectively. He obtained Ph. D. degree from Louisiana State University in multi-scale approaches for geo-materials. He was involved in many national and international projects while working for Sun Jin Engineering Co. Ltd., Daewoo Engineering Co. Ltd. and Sambo Engineering Co. Ltd. from 1988 to 1996 and 2000 to 2002 as a senior design engineer and a director of tunneling infrastructure division. He obtained a PE qualification in Korea in 1993 and qualified as an APEC engineer which is an international professional engineer recognized in more than 20 countries, including the US. He has published approximately 150 technical articles, three book chapters and two books. He was invited as a guest lecturer or invited speaker for the Korean Geotechnical Society, ASCE-Engineering Mechanics Div., several universities, Voyiadjis memorial symposium and other conferences in recognition of his expertise in geotechnical instrumentation, soil modeling, multi-scale and multi-pjysics approaches and soft soil improvement. Currently, Dr. Chung R. Song teaches geotechnical engineering at The University of Nebraska-Lincoln as an associate professor.

NDT approaches in transportation geotechnics

Dr. Sung-Hee (Sonny) Kim, Associate Professor, Civil and Environmental Engineering, University of Georgia

Abstract: In an effort to provide reliable decisions regarding subgrade soils embankment construction, compaction assessment is often conducted using non-destructive methods. It is advantageous to perform this condition assessment with the use of non-destructive technologies in order to eliminate damaging effects (ie. coring) to the structure. Ground penetrating radar (GPR) is a proven technology and useful tool for many different types of forensic investigations such as buried utilities, sinkholes and voids, delineation caused by washout beneath the surface. The presentation highlights the application of NDT in transportation geotechnics field. Besides, a brief introduction of tidal marsh restoration using remote sensing and machine learning will be presented.

Bio: Dr. Sung-Hee Kim is an associate professor of Civil Engineering at the University of Georgia. Kim's primary research has focused on transportation geotechnics and tidal marsh soils using nondestructive test (NDT), remote sensing, and machine learning. Dr. Kim is Fellow of the ASCE and also named Distinguished Faculty Fellow by College of Engineering from the University of Georgia. Dr. Kim is an active committee member of ASCE and TRB and serve MDPI Journal of Infrastructures and Innovative Infrastructure Solutions as an editorial board member. Dr. Kim is a licensed professional engineer and has written +100 refereed journal articles and reports.

Sinkhole vulnerability evaluation using Cone Penetration Testing (CPT): Central Florida case study

Dr. Boo Hyun Nam, Associate Professor, Department of Civil, Environmental, and Construction Engineering (CECE), Director of Florida Sinkhole Research Laboratory (FSRL), University of Central Florida (UCF)

Abstract: The greatest concern when constructing within karst terrain in Central Florida is the possibility of sinkholes. The Florida Office of Insurance Regulation (2010) reported that insurers had received 24,671 claims for sinkhole damage in Florida between 2006 and 2010, totaling $1.4 billion with an average of $280 million per year. Because of these geohazards, site characterization is essential to ensure a practical, yet safe, design during construction phases, and the project's life span. In this seminar, the speaker will present cone penetration test (CPT) based methods that can evaluate the vulnerability of sinkhole. Two proposing methods are: (a) sinkhole raveling chart and (b) Sinkhole Resistance Ratio (SRR). The raveling chart provides multiple zones that indicate different severities of sinkhole raveling. On the other hand, the SRR is an index that can score the resistance against sinkhole raveling, which is a function of encountered soil resistance values and stratigraphy thicknesses of the loose-soil anomalies. Both quantitative methods are designed for practical uses; thus, can help engineers select and design appropriate sinkhole remediation treatments.

Bio: Dr. Boo Hyun Nam is an Associate Professor in Civil, Environmental, and Construction Engineering (CECE), Director of Florida Sinkhole Research Laboratory (FSRL), at University of Central Florida (UCF). He received his Ph.D. in Civil Engineering at The University of Texas at Austin. Over the years, Dr. Nam has conducted research in the areas of sinkhole and subsidence, geomaterials and infrastructure materials (e.g. cement, concrete, and various geo-materials), and pavement engineering. Dr. Nam currently serves in multiple technical committees of ASCE Geotechnical-Institute (GI) and Transportation Research Board (TRB), and organization committees of The Sinkhole Conference, AEG Karst Hazards Forum, and so on. Dr. Nam has been awarded with funding from various prestigious organizations including the state and federal governments in multiple countries including the United States and South Korea. Dr. Nam has published more than 150

papers in peer-reviewed journals and conferences. He has been invited as keynote speakers at international conferences/workshops in the Middle East, East Asia, and the United States. Dr. Nam has been serving as the faculty advisor of the ASCE-UCF Student Chapter and was awarded the Faculty Advisor of the Year in 2016 by ASCE Florida.

Current status of design and construction of piles with a pilot hole

Dr. Soonkie Nam, Assistant Professor, Department of Civil Engineering and Construction, Georgia Southern University

Abstract: When piles are designed and constructed in the field, a pilot hole, which is a type of pile driving assistant method that prepare a hole before installing the pile, is often adopted to aid the installation process where the existence of hard or stiff layers is expected. This is to mitigate or prevent damage to the pile during the installation process, as well as to ensure the pile reaches the required minimum tip elevation. A conventional pile driving process can also cause excessive vibration or noise during the installation. With pile driving assistant methods, a pile can be installed with greater ease minimizing such issues when being inserted and seated on the bearing layer. However, as yet there are no clear design methodology and verification techniques that can be implemented in conjunction with LRFD. Skin friction is often ignored, and the capacity of pile is simply assumed to be the structural capacity of the pile. Therefore, research to develop more reliable design and construction methods to predict the capacity of piles where the installation involved drilling a pilot hole in the rock is thus urgently needed in order to identify appropriate resistance factors and establish an alternative design procedure for piles within the existing LRFD framework. Verifying the design and actual capacity is essential to either determine or improve the resistance factors that will eventually improve the reliability and reduce the construction cost. As a part of the research, this study presents a summary on the current guidelines for pile driving assistant methods that use a pilot hole adopted by different states and identifies challenges to improve the reliability and stability of the piles constructed with a pilot hole.

Bio: Dr. Soonkie Nam is an assistant professor of Civil Engineering and Construction Department at Georgia Southern University. Dr. Nam received his Ph.D. and M.S. degrees in Civil and Environmental Engineering from Virginia Tech and M.E. and B.E. degrees in Civil Engineering from Ajou University in South Korea. Before joining Georgia Southern University, he was an assistant professor at South Dakota School of Mines and Technology. He also served as an engineer officer in the Republic of Korea Marine Corps. Dr. Nam's research background has emphasized laboratory and in-situ geotechnical experiments, unsaturated soil experiments, and numerical modeling on seepage and slope stability. He has expanded his research interests on engineered materials in geotechnical systems and geotechnical structure health monitoring since he joined Georgia Southern.

Effect of water retention properties for municipal solid waste on landfill stability

Dr. Jongwan Eun, Assistant Professor, Department of Civil and Environmental Engineering, University of Nebraska-Lincoln

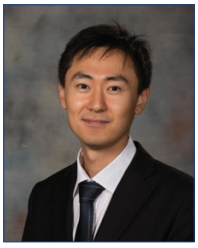
Abstract: In this study, unsaturated hydraulic properties of fresh MSW samples obtained from a landfill in Nebraska were evaluated, and the numerical simulation parameterized by the properties was performed to investigate the effect of water retention on the stability of actual landfill site in Nebraska under leachate circulations. A modified hanging column test combined with an air aspirator for higher suction pressures was used to obtain water retention curves of MSW specimens. The curves were fitted using Fredlung-Xing (FX), Van Genuchten (VG), and Brooks-Corey (BC) models. The FX model showed to have the best fit with the lowest Mean Square Error. The results of unsaturated hydraulic conductivity were calculated based on estimations by VG and BC. Different hydraulic properties in varying intervals of leachate circulations and locations were systemically applied in a slope stability analysis with the GeoSlope program employing Seepage/W. The results of a series of numerical simulations showed that MSW hydraulic and mechanical processes coupled with the water retention properties affect the factor of safety values, and the processes are recommended to be considered in the design of landfills.

Bio: Dr. Jongwan Eun is an Assistant Professor in the Department of Civil Engineering at the University of Nebraska-Lincoln (UNL). He received his Ph.D. in Civil and Environmental Engineering emphasized on Geoenvironmental Engineering from the University of Wisconsin-Madison in 2014 and M.S. from University of Texas at Austin in 2010. Dr. Eun has over 10 years of professional and academic experience in Geotechnical and Geoenvironmental Engineering. He worked for Dongmyung E&C Co. for more than 3.5 years as a field engineer mostly in subway construction site in South Korea. His research interest is focused on design and analysis of waste containment system, unsaturated soil mechanics, and geosynthetics application. His research results have been published in more than 40 national and international journal papers and proceedings. His research accomplishment involves foundation analysis based on ABAQUS simulation. He has been worked on analysis of helical piles to support a telecommunication tower with a local agency. Dr. Eun is a member of three technical committees (geosynthetics, and unsaturated soil mechanics) of Geo-Institute, ASCE. Dr. Eun serves as a reviewer for several journals such as the Journal of Geotechnical and Geoenvironmental Engineering, Journal of Testing and Evaluation, and Construction and Building Materials.

Pipe-pile-based micro-scale compressed air energy storage (PPMS-CAES) for a building

Dr. Seunghee Kim, Assistant Professor, Department of Civil and Environmental Engineering, University of Nebraska-Lincoln

Abstract: Compressed air energy storage (CAES) technology has been re-emerging as one of the promising options to address the challenge coming from the intermittency of renewable energy resources. Unlike the large-scale CAES, which is limited by the geologic location, small- and micro-scale CAES that uses a human-made pressure vessel is adaptable for both grid-connected and standalone distributed units equipped with the energy generation capacity. The research team recently suggested a new concept of pipe-pile-based micro-scale CAES (PPMS-CAES) that uses pipe-pile foundations of a building as compressed air storage vessels. To ascertain the mechanical feasibility of the new concept, we conducted lab-scale pile loading tests with a model test pile in both a loose and dense soil chamber that emulates an actual closed-ended pipe pile. The test pile was subjected to a repeated cycle of compressed air charge (to Pmax=10 MPa) and discharge (to Pmin=0.1 MPa) during the experimental study. The displacement at the top of the test pile, with and without a structural loading, in loose and dense sand, was closely monitored during the repetitive air pressurization-and-depressurization. It was observed that the vertical displacement at the pile head under different conditions was accumulated during the extended cycle of air charge and discharge, but the rate of displacement gradually attenuates during the cycle. And, the presence of structural load and density of soil affected the magnitude of the accumulated vertical displacement. From the analysis, it can be concluded that the concept of PPMS-CAES is not likely to compromise the mechanical integrity of pipe piles while showing a promising capacity for energy storage.



Bio: Dr. Seunghee Kim received his B.S. and M.S. from Korea Advanced Institute of Science and Technology (KAIST) and Ph.D. in Civil and Environmental Engineering from Georgia Tech. His graduate study focused on the subsurface investigation using surface waves (M.S.) and the geotechnical implications of CO2 geologic storage (Ph.D.). He continued his research on this topic as a postdoctoral fellow at the Bureau of Economic Geology, a part of the University of Texas at Austin. Before joining UNL, he was an assistant professor at Western New England University, MA. His main research area includes the pore-scale study of reactive/multiphase fluid flow in porous media, hydro-chemo-thermo-mechanically coupled processes in energy-geotechnology, and underground utilization. These topics are to tackle challenges for the success of many energy/environmental operations, such as carbon utilization & geologic storage, geothermal energy, energy storage, and nuclear waste sequestration. He has four years of industry experience related to the foundation design and the analysis of cut-slopes and tunnels.

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