3rd International Conference on

ACE Architectural, Civil and Environmental Forensic Engineering

January 23-25, 2024

Webinar (Zoom)

Korea University, South Korea

Organized by

f-PHI Hyper-converged Forensic Research Center for Infrastructure

KOREAN GEOTECHNICAL SOCIETY

KSSC KOREAN SOCIETY OF STEEL CONSTRUCTION

KOSHAM KOREAN SOCIETY OF HAZARD MITIGATION

Sponsored by

Ministry of Science and ICT

NRF National Research Foundation of Korea

3rd International Conference on

ACE Architectural, Civil and Environmental Forensic Engineering

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Welcome Message

On behalf of the organizing committee, I am sincerely pleased to invite you to the 3rd International Conference on Architectural, Civil and Environmental (ACE) Forensic Engineering at Korea University in Seoul, Korea. This 3rd international conference was organized by the Hyper-converged Forensic Research Center committee and hosted by the Korean Geotechnical Society (KGS), Korean Society of Steel Construction (KSSC) and Korean Society of Hazard Mitigation (KOSHAM).

This 3rd international conference takes place through an online Webinar (Zoom) during January 23-25, 2024 during 10:00 am to 5:00 pm in Korea Standard Time (KST). This conference aims to provide a current issue of Forensic Engineering relevant to failure, collapse and other performance problems of construction facilities and built environments. The conference covers three major infrastructures (Geotech, Structure and Hydro-environment) and discusses well-withstand, reacting and responding to large-scale complex disasters. A total of 29 distinguished speakers are invited to the 3rd international conference on three major topics (Geotech, Structure and Hydro-environment).

We would like to express the deepest gratitude to all the participants in this event and special thanks to all distinguished speakers for their commitment and dedication. We hope you have an enjoyable and meaningful time during the event and we look forward to learning from your productive insights.

Jong-Sub Lee, Ph.D., P.E.

***Professor**, School of Civil, Environmental & Architectural Engineering, Korea University*
***Chair**, 3rd International Conference on ACE (Architectural, Civil and Environmental) Forensic Engineering*
***PI**, Hyper-converged Forensic Research Center for Infrastructure, Korea University*
***Fellow**, National Academy of Engineering of Korea*
***Vice President**, International Affairs, Korean Geotechnical Society (KGS)*

jongsub@korea.ac.kr
geo-engineering.korea.ac.kr
fphi.korea.ac.kr

Day 1 Innovation in Geotechnical Engineering

Jan 23, 2024

10:15-10:20	**Welcoming Address** **Jong-Sub Lee** (PI, Hyper-converged Forensic Research Center for Infrastructure, South Korea)
10:20-10:30	**Complimentary Address** **Young Uk Kim** (President, Korean Geotechnical Society, South Korea)

Session 1 : Geotechnical Modeling and Monitoring

Chair: Jong-Sub Lee

10:30-11:00	**Predictive Groundwater Analysis Based on the Hydrogeological Model of Taichung Basin, Taiwan** **Keh-Jian Shou** (Vice President Asia, ISSMGE / Professor, National Chung-Hsing University, Taiwan)
11:00-11:30	**Monitoring of Peanut-Shaped TBM Launching Shaft Excavation Using Distributed Fibre Optics Sensing Technique** **Andy Y.F. Leung** (President, Hong Kong Geotechnical Society / Professor, The Hong Kong Polytechnic University, Hong Kong)
11:30-12:00	**Text Mining from Geotechnical Report: Integrated Approach by Convolutional Neural Network and Rule-Based Algorithm** **Tae Sup Yun** (Professor, Yonsei University, South Korea)
12:00-13:00	*Lunch*

Session 2 : Forensic Failure Assessment

Chair: Tae Sup Yun

13:00-13:30	**Evaluation Criteria for Safety of Agriculture Small Dams by AHP Method** **Eun Chul Shin** (Former Vice President Asia, ISSMGE / Emeritus Professor, Incheon National University, South Korea)
13:30-14:00	**Intersecting Geo-Hazard Analysis and Infrastructure Planning for Sustainability** **Mandip Subedi** (President, Nepal Geotechnical Society / Professor, Pokhara University, Nepal)
14:00-14:30	**Soil Stabilization Using a Novel Protein-Based Biopolymer** **Yong-Hoon Byun** (Professor, Kyungpook National University, South Korea)
14:30-15:00	*Break*

Session 3 : Piling and Foundations

Chair: Yong-Hoon Byun

15:00-15:30	**Comparison of Bearing Capacity of Model Boring DDS and CFA Piles on Problematical Soil Ground of Kazakhstan** **Askar Zhussupbekov** (Former Vice President Asia, ISSMGE / Professor, L.N. Gumilyov Eurasian National University, Kazakhstan)
15:30-16:00	**Shallow Geothermal Energy: Energy Foundations in Buildings and Infrastructure Projects and the Impact of Groundwater Flow** **Guillermo A. Narsilio** (Professor, The University of Melbourne, Australia)
16:00-16:30	**Geothermal Energy Piles, Applications and Research Aspects** **Fardin Jafarzadeh** (President, Iranian Geotechnical Society / Professor, Sharif University of Technology, Iran)
	Closing Comments

Day 2 Challenges in Geotechnical Engineering — Jan 24, 2024

09:50-10:00	**Introductory Comments & Welcoming Address**

Session 4 : Advanced Characterization Techniques — *Chair: Tae Sup Yun*

10:00-10:30	**Surface Wave Evaluation of Deep Soil Mixing** **Siau Chen Chian** (President, Geotechnical Society of Singapore / Professor, National University of Singapore, Singapore)
10:30-11:00	**Estimation of Geo-Properties Using Exponential Compaction Model** **Jong-Sub Lee** (Professor, Korea University, South Korea)
11:00-11:30	**A Holistic Approach for Data-Driven Probabilistic Site Characterization** **Jianye Ching** (President, Chinese Taipei Geotechnical Society / Professor, National Taiwan University, Taiwan)
11:30-12:00	**Deep Shear-Wave Velocity Profile: Case of Depok Campus UI** **Widjojo A. Prakoso** (President, Indonesia Society for Geotechnical Engineering / Professor, Universitas Indonesia, Indonesia)
12:00-13:00	*Lunch*

Session 5 : Safety and Serviceability I — *Chair: Jong-Sub Lee*

13:00-13:30	**Ethics and Dilemma in Engineering** **Ikuo Towhata** (Former Vice President Asia, ISSMGE / Professor, Kanto Gakuin University, Japan)
13:30-14:00	**Innovative Climate-Smart Nature-Based Technology for Slope Protection** **Mohammad Shariful Islam** (Professor, Bangladesh University of Engineering and Technology, Bangladesh)
14:00-14:30	**Overview on Ground Treatment Design for Electrified Double Track in Northern Part of Peninsular Malaysia** **Peir-Tien LEE** (President, Malaysian Geotechnical Society, Malaysia)
14:30-15:00	*Break*

Session 6 : Safety and Serviceability II — *Chair: Yong-Hoon Byun*

15:00-15:30	**Towards to Harmonizing Using of the Probabilistic Seismic Hazard Assessment Results in Seismic Codes** **Pulod Aminzoda** (President, Tajikistan Geotechnical Society / Director, Institute of Geology, Earthquake Engineering and Seismology, Tajikistan)
15:30-16:00	**Innovation in Geotechnical Engineering from Soil Mechanics to Geotechnical Engineering** **Amjad Agha** (President, Pakistan Geotechnical Engineering Society, Pakistan)
16:00-16:30	**Case Studies - Forensic Study of Foundation Failures and Monitoring Impact during High-Rise Demolition** **Anil Joseph** (President, Indian Geotechnical Society / Managing Director, Geostructurals Pvt. Ltd., India)
	Closing Comments

Day 3 Advanced Structural Engineering / AI, ML and Optimization Technique for Water and Environmental Forensic Engineering

Jan 25, 2024

09:50-10:00	**Introductory Comments & Welcoming Address**
Session 1 : Forensic Structural Engineering I	*Chair: Seungjun Kim*
10:00-10:30	**Crack Patterns of Unbonded Post-Tensioned Members and Seismic Retrofitting Techniques Using CFRP** **Uksun Kim** (Professor, California State University - Fullerton, USA)
10:30-11:00	**Structuring Shear Wall Buildings Based on Artificial Neural Networks** **Leonardo Massone** (Professor, University of Chile, Chile)
11:00-11:30	**Integrating Machine Learning into Building Codes: Establishing Equivalence through Causality and Intuition** **M.Z. Naser** (Professor, Clemson University, USA)
11:30-12:00	***QnA Session***
12:00-13:00	*Lunch*
Session 2 : Forensic Structural Engineering II	*Chair: Thomas Kang*
13:00-13:30	**Study on Failure Modes and Load-Carrying Capacity of a Transmission Tower** **Seungjun Kim** (Professor, Korea University, South Korea)
13:30-14:00	**Impact Performance of Reinforced and Post-Tensioned Concrete One-Way & Two-Way Members** **Thomas Kang** (Professor, Seoul National University, South Korea)
14:00-14:30	**Advancing Roller-Compacted Concrete Pavements for Heavy-Load Container Terminals: A Study on Optimizing Structural Design under Increased Stacking Pressures** **Emin Sengun** (Professor, Ankara Yildirim Beyazit University, Türkiye)
14:30-15:00	***QnA Session***
Session 3 : AI, ML and Optimization Technique for Water and Environmental Forensic Engineering	*Chair: Donghwi Jung*
15:00-15:30	**System and Model Robustness for Hydrosystems in the Era of the Fourth Industrial Revolution** **Donghwi Jung** (Professor, Korea University, South Korea)
15:30-16:00	**Advancing Real-Time In-Situ Environmental Monitoring Using Autonomous Unmanned Vehicles** **Jae Hyeon Ryu** (Professor, University of Idaho, USA)
16:00-16:30	**Artificial Electric Field Algorithm for Training Multilayer Perceptron Models** **Anupam Yadav** (Professor, Dr. B. R. Ambedkar National Institute of Technology Jalandhar, India)
16:30-17:00	**Artificial Intelligence for Advancing Water Treatment Research and Development** **Nurul Alvia Istiqomah** (Lecturer, Universitas Gadjah Mada, Indonesia)
17:00-17:30	***QnA Session***
	Closing Comments

Predictive Groundwater Analysis Based on the Hydrogeological Model of Taichung Basin, Taiwan

Keh-Jian Shou
National Chung-Hsing University
kjshou@dragon.nchu.edu.tw

This study used the hydrogeological model to simulate the relationship between rainfall and groundwater in the Taichung basin, Taiwan. Since the gravelly soil horizons in Central Taiwan are enriched with groundwater, the groundwater monitoring is essential, for different purposes, including water supply, dewatering, flooding control, etc. In this study, a hydrogeological model was established for Taichung basin. The groundwater level data from 10 monitoring stations in the past 10 years were used to calibrate the hydrogeological parameters, before the model was used to predict the groundwater conditions for the extreme scenarios of climate change. The results revealed that Taichung City was influenced by the groundwater recharge effects of Tachia River in the north, the border of Tadu Plateau in the west, Dali River in the south, and the no-flow boundary of Chelungpu Fault in the east. In general, the groundwater level in the Taichung basin was higher in the north and lower in the south. Most areas of the Taichung basin exhibit a seepage coefficient around 0.1 cm/sec, however, the areas to the north, near the Tachia River, exhibit a lower seepage coefficient around 0.02 cm/sec.

Keh-Jian (Albert) Shou was elected VP Asia of ISSMGE (2022-2026), Chair of International Society for Trenchless Technology (2022-2025), Honorary Chairman of CTSTT, and Distinguished Professor of Department of Civil Engineering, National Chung-Hsing University, Taiwan. His research interests include rock mechanics/engineering, engineering geology, and trenchless technologies. He has published more than 200 papers on these topics and is now the editor of Tunnelling and Underground Space Technology, and the associate editor of the ASCE Journal of Pipeline Systems Engineering and Practice. He obtained his Ph.D. degree (Civil Engineering) from University of Minnesota, U.S.A. in 1993. His major experience includes: 1. Visiting Professor, CNR-IRPI, Perugia, Italy (2013/8-2014/1). 2. Senior Principal Engineer, Shannon & Wilson, Seattle, USA (2008/2-2008/9), 3. Visiting Professor, TTC, Louisiana Technical University, USA (2006/1-2006/2), 4. Visiting Professor, RCUSS, Kobe University, Japan (2003/10-2004/3), 5. Research Engineer, CSIR/Miningtek, South Africa (1998/2-1999/1), 6. Geotechnical Engineer, National Expressway Engineering Bureau, Taiwan (1993-1994).

Monitoring of Peanut-Shaped TBM Launching Shaft Excavation Using Distributed Fibre Optics Sensing Technique

Andy Yat Fai Leung
The Hong Kong Polytechnic University ✉ andy.yf.leung@polyu.edu.hk

This talk presents the results from a successful case study of the application of distributed fibre optics sensing techniques for monitoring of a peanut-shaped tunnel boring machine (TBM) launching shaft in Hong Kong. The study involves collaborative efforts from the Civil Engineering and Development Department and The Hong Kong Polytechnic University. The peanut-shaped TBM launching shaft, with radius of approximately 20 m to 22 m and excavation depth of approximately 38 m, was constructed to enhance construction flexibility by eliminating steel struts, facilitate faster shaft excavation, assembly of the TBMs and construction of the permanent tunnel box structure and significantly reduce impact on adjacent structures and environment. The high spatial resolution in strain measurements by distributed fibre optic sensing revealed interesting behaviour the diaphragm wall panels, which utilized hoop action to support the excavation. The variations of the measured hoop stresses and circumferential bending moments in the wall, and their patterns in association with the excavation procedures will be discussed.

Andy Y.F. Leung is currently Associate Head (Partnership) and Associate Professor at the Department of Civil and Environmental Engineering, The Hong Kong Polytechnic University. He graduated from The University of Hong Kong (BEng) and University of California, Berkeley (MS), before he obtained PhD degree at the University of Cambridge, UK. He is a professional engineer in the State of California, United States, and has also practiced as a geotechnical engineer in Hong Kong before joining the academia. His research interests include soil-structure interaction, reliability of geotechnical and structural systems, probabilistic analysis approaches and novel geotechnical instrumentation technologies. He has received various awards on research, teaching excellence and knowledge transfer. He has been serving as the President of Hong Kong Geotechnical Society since 2022.

Text Mining from Geotechnical Report: Integrated Approach by Convolutional Neural Network and Rule-Based Algorithm

Tae Sup Yun
Yonsei University
✉ taesup@yonsei.ac.kr

This study developed an algorithm and platform for automatically extracting engineering data from geotechnical investigation reports. The type and format of various field and laboratory test results in the report are highly varying depending on the project objectives and investigating agencies such that the consistent extraction of data is challenging. Therefore, this study implemented a convolutional neural network (CNN) to identify and classify the types of detailed reports, coupled with a rule-based algorithm for data extraction from the identified reports. The CNN model classified all the pages contained in the report and determined which of them were relevant for subsequent data extraction. The data extraction algorithm first analyzed the page layout of the identified detailed reports using a line detection technique to distinguish between general information and geotechnical data sections. A predefined rule-based algorithm was then applied to navigate through the cells containing the desired element names and values for extraction. The trained CNN model demonstrated high accuracy in identifying detailed reports, while the data extraction algorithm effectively retrieved the targeted elements and their corresponding values. In addition, this algorithm was integrated into a user-friendly interface platform that allowed users to upload documents for data extraction, select relevant reports, and view the extracted data along with visual representations of the corresponding PDF document pages. This integrated approach provides a robust and efficient method for extracting and visualizing engineering data from various geotechnical investigation reports, significantly improving data accessibility and usability in geotechnical engineering applications.

Tae Sup Yun is a Professor at the Department of Civil and Environmental Engineering at Yonsei University, and now serves as an Associate Dean in College of Engineering (2020-2022). Tae Sup Yun received his bachelor's degree in Geology from Yonsei University in 1997. In 2001, he entered the civil and environmental engineering graduate program at the Georgia Institute of Technology (Georgia Tech) where he received his M.S. and Ph.D. in 2003 and 2005. Then, he was hired as a P.C. Rossin Assistant Professor at Lehigh University. In 2009, he joined Yonsei University. His research interests include deep learning based analysis of geotechnical visions and images, optimization of tunnelling by artificial intelligence, multi-phase fluid flow, and geophysical characterization of geomaterial.

Evaluation Criteria for Safety of Agriculture Small Dams by AHP Method

Eun Chul Shin
Incheon National University
ecshin@inu.ac.kr

The heavy rainfall during the summer rainy season is the most critical factor threatening the stability of small earth dams. The flooding and overflow of small dams are resulted in deterioration of the entire dam system. The integrity of small dams in Korea has been a problem for safety of its structures and maintains its long-term storage capacity. There are more than 17,000 agriculture reservoir and small dams are existed in the Korean Peninsula, most of these dams are being used for the agriculture purpose. Most of these dams were constructed by earth fill method and now they are aged and constructed by low quality conventional construction technology. The statues of reservoirs and dams and found out 68.4 % of dams are more than 50 years old. The flooding and overflow of small dams are resulted in deterioration of the entire dam system. The sedimentation drifted soil from upstream and leakage of water through embankment dam are caused by the aging of dam structures, rapid lowering of the water levels with seasonal rainfall and the usage of water. The Korean local government conducts the small dam safety inspection in once a year regularly by following the safety check lists like USA and Japan. Most of local government does have several civil engineers who is in charge of dam safety related work. However, the person who is in charge of dam safety inspection in the local government is needed more experienced civil engineers. These results indicate that it is a quite difficult to manage the dam safety systematically as well as efficiently. Several researchers (ICOLD, 1974, 1983, 1995; Ju, 2010) investigated the cause of failure for reservoirs and small dams for many years and classified into overtopping, piping, sliding, and other causes. After compilation of failure case studies by Lou (1981), BRE (2002), ICOLD (1995), Foster et al. (1998), it is turned out to be the highest cause of failure is a piping (47.5 %) because the earth fill dams were dominated in the old days, and overtopping (39.1 %) is the second cause, sliding (7.2 %), and other causes (6.2 %).

Several researchers reported on the influence factors (Yasser et al., 2013; Dai, 2016; Kaw and Manaf, 2018) for using in the analytic hierarchy process (AHP) and safety checklist with classification of inspection points into several major groups (OERB, 2010). This paper presents the safety evaluation method for based on 75 agriculture reservoir and small dam by using AHP with considering condition of embankment (61.91 %), spillway (23.9 %), and water intake facility (14.19 %) of dam structure.

E.C. Shin is an Immediate Past Vice President of ISSMGE for Asia. Now Prof. Emeritus at The Incheon National University. He was born in Korea and graduated from Chungbuk National University in Korea. He obtained his M.S. degree from the University of Colorado at Boulder, USA in 1987 and a Ph.D. degree from the Southern Illinois University at Carbondale, USA in 1994. Since graduation, he has been teaching geotechnical Engineering at the Incheon National University, Korea, where he obtained a full professorship in 2005 and has served as dean of the Urban Science Collage until 2016. Prof. E.C. Shin was twice awarded the Outstanding Research Professor title from the Incheon National University in the years of 1997 and 2010. He also serves an adjunct professor in the Ph.D. program of the Geotechnical Institute at the L.N. Gumilyov ENU, Kazakhstan, where he has been working since 2006. In the past 30 years, he has been a devoted member of the geotechnical activities in Korean Geotechnical Society (Now, The Advisor of KGS). He hosted 3 International Conferences, May 2006-Sustainable Development, May 2014-Disaster Prevention and Reduction, May 2016-Cold Region Development in Incheon, Korea. He contributed to the success of many activities took place under the umbrella of ISSMGE, most notably in the technical committees of mega city, soil reinforcement, historical monument, and environmental geotechnics. He delivered numerous invited keynote lectures in the international geotechnical and geosynthetics conferences hosted in Asia and South America. He also participated in several geotechnical and geosynthetics touring lectures organized by the ISSMGE and the International Geosynthetic Society in many international locations as a keynote speaker.

Intersecting Geo-Hazard Analysis and Infrastructure Planning for Sustainability

Mandip Subedi
Pokhara University
✉ mandip.subedi@gmail.com

Inadequate site investigation and geotechnical study have led to global project failures, particularly in seismically active regions like Nepal. This study emphasizes the significance of geohazard analysis in sustainable infrastructure planning. The research examines two cases: first, the importance of liquefaction mapping in urban planning in Kathmandu, comparing liquefaction hazard analysis with settlement growth patterns. The liquefaction hazard analysis showcased discrepancies in urban planning decisions, leading to vulnerable settlements in high-risk areas. Second, it explores the impact of multiple hazards on the vital Narayanghat-Kathmandu Highway (146 km), Nepal's crucial transportation route making it the backbone of the country's economy, which faces frequent disruptions, particularly during the monsoon season. Employing Analytical Hierarchy Process (AHP) and Geographic Information System (GIS), the study assesses and maps hazards along the highway, aiding disaster risk reduction and policymaking. It also considers alternative routing strategies to enhance highway resilience. For the Narayanghat-Kathmandu Highway, hazard mapping identifies critical areas prone to landslides, slope failures, and debris flows, emphasizing the need for focused research and improved disaster preparedness. Geo-hazard analysis must be integrated into decision-making processes for urban planning, open areas, new settlements, and large infrastructures to ensure resident safety. Additionally, comprehensive hazard assessment and alternative routing strategies are crucial for the resilience of the highways like Narayanghat-Kathmandu Highway.

Mandip Subedi is Director of Universal Engineering and Science College, Affiliated Pokhara University (2013-till date). Mandip Subedi had received his bachelor's degree from Institute of Engineering, Tribhuvan University (2007). He completed MSc in Geotechnical Engineering (2010) and PhD in Geotechnical engineering (2023) from the same institution. Mr. Subedi has been working in Geotechnical Earthquake Engineering with World Bank and different governmental and non-governmental projects. He is carrying out research mainly on soil liquefaction, geo-disaster, earthquake and geotechnical engineering. His research jointly done with Dr. Indra Prasad Acharya had been awarded for "Best Paper Award-2022" from the Journal Geoenviromental Disasters (Springer Publication) for the paper "Liquefaction hazard assessment and ground failure probability analysis in Kathmandu Valley of Nepal". He is a member of International Society of Soil Mechanics and Geotechnical Engineering (ISSMGE) and President of Nepal Geotechnical Society (NGS) (2023-2025).

Soil Stabilization Using a Novel Protein-Based Biopolymer

Yong-Hoon Byun
Kyungpook National University
✉ yhbyun@knu.ac.kr

In geotechnical engineering, the application of biopolymers for soil stabilization has gained significant traction due to their sustainable and eco-friendly properties. Recently, zein—a protein biopolymer extracted from the endosperm of maize with a benzene solution—has been utilized to enhance soil strength. This lecture explores the effects of zein on the strength of sandy soils and its rheological behavior under various solvent and curing conditions. The research involves analyzing the mechanical and microstructural properties of soil specimens with different zein concentrations after curing. Characterized by shear-thickening and time-dependent viscosity, zein is critical to its stabilization efficacy. The findings suggest that an increased biopolymer content and extended curing durations significantly improve the compressive strength and elastic modulus of the treated soil. The ethanol content of the solvent and the curing temperatures are pivotal to these enhancements. Compared to other biopolymers, such as casein and lignin, zein demonstrates superior strengthening effects, indicating its potential as an exceptional binder. The lecture concludes that utilizing the potential of zein for soil stabilization requires a comprehensive understanding of its distinct properties and the significant influence of solvent and curing conditions, leading to more sustainable and effective construction practices.

Yong-Hoon Byun is currently working as an Associate Professor at the School of Agricultural Civil & Bio-Industrial Engineering at Kyungpook National University (KNU). He received his bachelor's degree (2009) and his Ph.D. (2014) in Civil and Environmental Engineering from Korea University. After working at Korea University for one year (2014-2015), he joined the Transportation Geotechnics research group at the University of Illinois as a Postdoctoral Research Associate in 2015. In 2017, he was hired as an Assistant Professor in Kyungpook National University. He specializes in characterization of various geo-materials using advanced in-situ testing methods and wave-based nondestructive testing methods. He is the Associate Editor of the International Journal of Geo-Engineering and the Editorial Board Member of Journal of Korean Society of Agricultural Engineers. He was honored with Young Researcher Awards by Korean Geotechnical Society (2018) and Korean Society of Agricultural Engineers (2021). His research interests are environmental-friendly binders and geosynthetics for embankment stabilization and advanced monitoring systems for transportation substructure and earth dam.

Comparison of Bearing Capacity of Model Boring DDS and CFA Piles on Problematical Soil Ground of Kazakhstan

Askar Zhussupbekov
L.N. Gumilyov Eurasian National University /
Saint Petersburg State University of Architecture and Civil Engineering /
Moscow State University of Civil Engineering
✉ astana-geostroi@mail.ru

Drilled piles installed using CFA (Continuous Flight Auger) and DDS (Drilled displacement system) technologies are relatively new construction products on the market of Kazakhstan for the last 15 years, but already today the technology has a significant practical value in the construction of the cities of Astana, Almaty and other regions. This lecture presents of model tests of bored piles installed by using Drilled Displacement System (DDS) and Continuous Flight Auger (CFA) technologies on a volumetric stand. For testing we used 1:20 scale, piles diameter was 20 mm, length was 300 mm. Drilling was performed using augers that were prepared in advance on a 3D printer. The load on the model piles was applied in steps of 39 N up to the ultimate load of 391 N. Based on the results of the study, the "settlement-load" diagram of the DDS and CFA model piles were obtained, as well as a comparison of the bearing capacity of these piles by static test method. Based on the study, it was found that the DDS piles showed good bearing capacity performance compared to the bearing capacity of CFA piles. Overall, the results of the study provide valuable information on the performance behavior of DDS and CFA piles, which can be used to optimize their design and installation in different soil types.

This lecture presents of the results of the geotechnical construction and testing of model of boring DDS and CFA piles in modelled soil ground with comparison of numerical analysis and field test results of static boring DDS and CFA piles.

These applications are important for understanding of interaction of DDS and CFA boring piles with problematical soil ground of Kazakhstan.

Askar Zhussupbekov is a Professor of Department of Civil Engineering of Eurasian National University (ENU, Kazakhstan) and also adjunct professors of Saint Petersburg State University of Architecture and Civil Engineering (SPBGASU), and Moscow State University of Civil Engineering (MGSU), Russia, and Director of Geotechnical Institute of ENU , Kazakhstan. Askar Zhussupbekov received his bachelor's degree and master's degree in civil engineering from Saint Petersburg State University of Architecture and Civil Engineering (SPBGASU), Russia, in 1977. After working for the Karaganda State Industrial University (1977-1982), Kazakhstan, as an assistant professor, he entered the geotechnical engineering graduate program at the Saint Petersburg State University of Architecture and Civil Engineering (SPBGASU), Russia in 1982. In 1985, he received his Ph.D. from SPBGASU. In 1986, he was hired as an Associate Professor in Karaganda State Industrial University (Kazakhstan), where he became to Professor and First Vice-Rector of Karaganda State Industrial University. He is now President of Kazakhstan Geotechnical Society ,Kazakhstan Geosynthetic Society and as well as consulting work for civil and geotechnical projects at new capital Kazakhstan (Kazakhstan), West Kazakhstan (Caspian Sea area), Almaty (old capital of Kazakhstan), Saint-Petersburg, Moscow, Yuzhno-Sakhalinsk (Russia). He delivered several keynote lectures in international conferences including the 16th Asian Regional Conference of Geotechnical Engineering (ISSMGE). He is a chair of TC 305 «Geotechnical Infrastructure for Megacities and New Capitals» of ISSMGE. His research interests are geotechnical engineering (piling and deep foundations), geomonitoring, undermining soil ground, disaster prevention and reduction, in situ testing, preservation of historical sites. He has published more than 400 scientific papers, including 10 books on Geotechnical Engineering. He has been supervised more than 50 Dr. Ph. dissertations and 10 Dr. Engineering dissertations (included foreign students from Japan, Turkey, South Korea, Cambodia, Tanzania, Tajikistan, China, Mongolia, India, Taiwan, Russia). He is a member of ASCE, GGS, SEAGS, RSSMGE, ISSMGE, IGS. He is Member of National Engineering Academy of Kazakhstan.

Shallow Geothermal Energy: Energy Foundations in Buildings and Infrastructure Projects and the Impact of Groundwater Flow

Guillermo A. Narsilio
The University of Melbourne
narsilio@unimelb.edu.au

The use of ground source heat pump (GSHP) or shallow geothermal energy systems has already been proven to be a viable alternative to provide space heating and cooling. However, while the number of installations are steadily increasing worldwide, there is still a lack of general awareness among engineers, architects, and the general public alike. In this lecture, we summarise the general working principles and the potential for the use of such technology in residential, commercial, industrial and infrastructure projects. In addition, the novel dual use of geo-structures as both foundations and heat exchange elements is introduced (e.g., "energy piles", "energy walls"). In close loop systems, a heat carrier fluid (typically water or a water-antifreeze solution) circulates within high density polyethylene pipes embedded into the ground and exchanges heat with it primarily via conduction and convection. When heating is needed (i.e., winter) heat is transferred from the ground to the fluid, and when cooling is required (i.e., summer), from the fluid to the ground. The pipes are connected to a GSHP which uses the temperature difference between the supply and return pipes to upgrade this thermal energy and provide space (and water) heating or cooling. For every kilowatt-hour used to run the system, typically 4 to 5 kilowatt-hour of thermal energy is achieved throughout the year (i.e., coefficient of performance ~ 4 to 5). This is because the ground acts as a constant temperature source/sink of heat, for example, the ground temperature in Melbourne is approximately 18 °C (about 14 °C in Seoul) in the first 100 metres from the ground surface. Various designs and installations are showcased for different applications, including in rural industries and in large urban infrastructure projects using energy geostructures.

Guillermo A. Narsilio is Deputy Head of the Department of Infrastructure Engineering at the University of Melbourne (2020–today) and Chair of the ISSMGE Technical Committee 308 on Energy Geotechnics. He is a former member of the ARC College of Experts (2018–2021). Dr. Narsilio is also a past Chair of the Australian Geomechanics Society (Victoria Chapter, 2019–2020) and a former Australian Research Council (ARC) Future Fellow. Dr Narsilio received his Ph.D. in Geotechnical Engineering (2006) and his Masters in Mathematics (2006) and in Geotechnical Engineering (2003) from Georgia Institute of Technology (US). He obtained his Civil Engineering degree from the National University of Cordoba (Argentina) in 2001. He undertook his postdoctoral experience at the University of Melbourne where he is now a Professor. His research interests include numerical modelling, multi-scale porous material characterisation and performance and the (sustainable) energy industry; with emphasis on basic and applied shallow and deep geothermal energy systems and the use of AI.

pmrl.eng.unimelb.edu.au

Geothermal Energy Piles, Applications and Research Aspects

Fardin Jafarzadeh
Sharif University of Technology
✉ fardin@sharif.edu

Nowadays minimizing the use of energy in residential, commercial, and office buildings and towers and using clean energy sources instead of fossil sources, is one of the most important aspects of sustainable development in societies and megacities. One of the optimum solutions for this purpose is using Geothermal piles in foundation of structures. Geothermal piles consist of pile foundations combined with closed-loop ground source heat pump systems. Their purpose is to provide support to the building, as well as acting as a heat source and a heat sink. Nowadays, most of this required energy is provided through burning fossil fuels which is responsible for severe environmental catastrophes over the past decades. Geothermal heat pump systems can be coupled with geostructures in different manners to make different types of so-called energy geostructures such as energy piles energy tunnels, energy diaphragm walls, etc. Soil temperature at depths larger than around 10 m is unaffected by ground surface seasonal temperature variations throughout the year. That is to say, a heat conveying fluid is used to exchange heat between ground and indoor space by being circulated through.

In this presentation the response of a 2×2 pile group to unsymmetrical cyclic thermal loading is studied using 1g physical model tests. The unsymmetrical thermal loading is applied by including 1, 2 and 3 energy piles in the pile group in unsymmetrical arrangements. A total number of six physical model tests are conducted in dry and partially-saturated silty sand. Model piles were closed-end aluminum tubes with 60 cm in length and 2 cm in diameter. The results corresponding to the tests in partially-saturated ground condition are discussed in detail while some of the results of the tests in dry condition are presented for comparison. It was observed that the unsymmetrical thermal loading of the pile group may cause unallowable tilting of the pile cap.

Fardin Jafarzadeh is a Professor at the Civil Engineering Department at Sharif University of Technology (SUT), and also President of Iranian Geotechnical Society (IGS) since 2019. Fardin Jafarzadeh received his bachelor's degree in in civil engineering from Tehran University in 1988 and his master's degree in soil & foundation engineering from Tehran University in 1990. In 1995, he received his Ph.D. from Tohoku University in Sendai, Japan, where he served as Research Associate for one year. In 1995, he was hired as a Research Associate in Tohoku University for one year. In 1996 he was hired by Sharif University of Technology as assistant professor, where he is currently an Associate Professor. He has been very active in ISSMGE activates and delivered many keynote lectures and technical papers in international conferences. Fardin Jafarzadeh has established himself as a prominent figure in geotechnical engineering, with over 25 years of academic and industrial experience. Dr. Jafarzadeh's research expertise spans various fields of geotechnical engineering, including soil dynamics and geotechnical earthquake engineering, ground improvement, unsaturated soil mechanics, physical modeling of energy piles, earth, and rockfill dams, constitutive modeling, and monitoring & retrofitting of geotechnical structures. He has been the head of the Advanced Geotechnical Laboratory at SUT since 2014, actively overseeing the installation and upgrade of advanced laboratory equipment for element tests. In 2006, he established the Physical Modeling Laboratory to investigate the static and dynamic behavior of soil in geotechnical earthquake engineering and geothermal energy piles. Dr. Jafarzadeh's research findings have been published in over 100 articles in top-tier scholarly journals and peer-reviewed conference proceedings. He has also supervised more than 70 MSc. and 10 Ph.D. students, mentoring the next generation of geotechnical engineers.

Surface Wave Evaluation of Deep Soil Mixing

Siau Chen Chian
National University of Singapore
✉ sc.chian@nus.edu.sg

Evaluating spatial mechanical properties of deep soil mixing (DSM) presents inherent challenges, primarily due to limited access below ground. Non-destructive surface wave methods can offer an estimate of the stiffness of the cement stabilised soil. However, the strength development of the ground after DSM changes with time which brings complexities, such as multi-mode phenomena and inversion non-uniqueness. These complexities typically require detailed manual analysis and reassessment. This lecture presents a novel, data-driven sequential surface wave inversion framework with Monte Carlo Tree Search (MCTS) algorithm to track time-variant subsurface properties, specifically in terms of shear wave velocity (Vs). Results are validated by simulations with synthetic data emulating DSM scenarios. The framework is thereafter applied to an actual DSM site which gave close estimates of the unconfined compressive strength of the cored sample from two DSM layers based on the measured Vs and borehole data, enabling the bridging of understanding between geophysics and geotechnical engineering.

Darren SC Chian is an Associate Professor at the Department of Civil and Environmental Engineering, National University of Singapore (NUS). He obtained his Ph.D. and B.Eng. (1st Class with Gold Medal) from Cambridge University and Nanyang Technological University respectively. Dr. Chian is the Secretary of the ISSMGE TC217 Land Reclamation and Nominated Member of the TC203 Earthquake Geotechnical Engineering and TC104 Physical Modelling in Geotechnics. He is also the President of the Geotechnical Society of Singapore and the Chair of the National Technical Committee of Civil and Geotechnical Works, overseeing building codes and practices in Singapore. Dr. Chian is recognised as Asia's Top 10 Innovators Under 35 by the MIT Technology Review and Singapore Accreditation Council (Distinguished) Award in 2016 and 2020 respectively. He was also awarded the top Minister's Innovation Award (Distinguished), Land Transport Excellence Award (Innovation), and Singapore's Prominent Geotechnical Engineer by the Geotechnical Society of Singapore in 2022.

Estimation of Geo-Properties Using Exponential Compaction Model

Jong-Sub Lee[1], Namsun Kim[1], Junghee Park[2]
Korea University[1], Incheon National University[2] ✉ jongsub@korea.ac.kr

The objective of this study is to estimate effective stress-dependent engineering soil properties and estimate various ground conditions that vary with depth. The target ground analyzed in this study consists of non-compacted embankment layers and liquefiable ground with fine-dominant soil deposits. For the non-compacted embankment layer, embedded soil stiffness measurement devices were developed to monitor shear waves during each stage of filling, and comprehensive laboratory compaction tests were conducted using a floating-ring oedometer cell to minimize the friction effect. The measured results were analyzed using the exponential compaction model, this approach anticipated the effective stress-dependent geotechnical properties such as relative density and shear wave velocity analyzed in the context of the depth in non-compacted embankment layers. In the case of liquefiable fine-grained ground, this study used multi-geophysics techniques for site characterizations and laboratory tests. Depth-dependent engineering soil properties were analyzed using effective stress–depth models, where extensive datasets compiled from previous studies enhance data reliability. A data-driven framework successfully established a lower bound for low plastic clay and an upper bound for loose silt for porosity, electrical resistivity, and shear wave velocity data and divided the sediment into four different soil layers. The data interpretation approach and physical model framework proposed in this study may provide the relative density and shear wave velocity of the depth in the non-compacted embankment layers and can be applied for the evaluation of liquefaction susceptibility for fine-dominant soil deposits.

Jong-Sub Lee is a Professor at the School of Civil, Environmental, and Architectural Engineering at Korea University, and had served as an Associate Dean at the Graduate School, Korea University (2017-2019). Jong-Sub Lee received his bachelor's degree in in civil and environmental engineering from Korea University in 1991 and his master's degree in civil and environmental engineering from KAIST (Korea Advanced Institute of Science and Technology), Korea in 1993. After working for the Hyundai Engineering and Construction Company for seven years (1993-1999) as a research engineer, he entered the civil and environmental engineering graduate program at the Georgia Institute of Technology (Georgia Tech) in 2000. In 2003, he received his Ph.D. from Georgia Tech. In 2005, he was hired as an Assistant Professor in Korea University, where he is currently a professor. He is a Principal Investigator (PI) of Hyper-converged Forensic Research Center for Infrastructure (ERC sponsored by National Research Foundation of Korea). He delivered many keynote lectures in international conferences including the 19th International Conference on Soil Mechanics and Geotechnical Engineering (ICSMGE) and the 17th Asian Regional Conference (ARC) on Soil Mechanics and Geotechnical Engineering. He is member of the National Academy of Engineering of Korea. He published more than 276 journal papers (163 international and 113 national) and 300 conference papers. His research interests are non-destructive testing and evaluation with advanced sensing, in-situ subsurface characterization, and foundations.

A Holistic Approach for Data-Driven Probabilistic Site Characterization

Jianye Ching, Hassan Kamyab
National Taiwan University
jyching@gmail.com

In the past, data-driven soil-layer delineation and conditional random field simulation are usually conducted using two steps. First, borehole/sounding data are used to delineate soil layers. Then, random fields of soil parameters conditioning on the borehole/sounding data within each soil layer are simulated. This study proposes a novel holistic data-driven approach of delineating soil layers and simulating conditional random fields at the same time. The basic idea is to include liquid limit (LL), plasticity index (PI), and fines content (FC) into the soil parameters of interest. According to the Unified Soil Classification System (USCS), the information of (LL, PI, FC) can be used to determine whether the soil is sand, silt, or clay. The conditional random field simulation results for (LL, PI, FC) can also be used to delineate sand, silt, and clay layers. As a result, soil-layer delineation becomes a by-product of conditional random field simulation for (LL, PI, FC). There is a missing link when the simulation domain extends beyond the existing boreholes/soundings, and this missing link is amended by the Markov random field approach. Real examples are adopted to demonstrated the application of the novel holistic approach.

Jianye Ching is a Distinguished Professor in the Dept. of Civil Engineering at National Taiwan University. He obtained his Ph.D. degree in 2002 in University of California at Berkeley. His main research interests are geotechnical risk & reliability, random fields & spatial variability, probabilistic site characterization & geotechnical data analytics.

He is the immediate past Chair of TC304 (risk) in ISSMGE and the immediate past Chair of Geotechnical Safety Network (GEOSNet). He is Managing Editor of Georisk, Associate Editors of ASCE Journal of Geotechnical and Geoenvironmental Engineering, Canadian Geotechnical Journal & ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, and Editorial Board Member of Structural Safety. He has published more than 150 papers in international journals.

Dr. Ching is the recipient of the Outstanding Research Award (2011, 2014) and the Wu-Da-Yu Award (2009) from the Ministry of Science and Technology of Taiwan. He was elected as the 7th ISSMGE Suzanne Lacasse Lecturer in 2022. He is now the Convener of Civil & Hydraulic Engineering Program of the National Science and Technology Council of Taiwan and the President of Chinese Taipei Geotechnical Society (a member society of ISSMGE).

Deep Shear-Wave Velocity Profile: Case of Depok Campus UI

Widjojo A. Prakoso
Universitas Indonesia
wprakoso@eng.ui.ac.id

Many parts of Indonesia are seismically active, and the greater Jakarta area is one of those areas with high seismic risks. Depok Campus of Universitas Indonesia is in the southern part of that greater area. Within the Depok Campus, there are three accelerometers installed by the Indonesian Agency for Meteorological, Climatological and Geophysics, including one accelerometer installed at a depth of 300 m paired with a surface accelerometer. The geotechnical characteristics of these two locations have been surveyed using geotechnical and geophysical methods. One of the seismic events recorded by these accelerometers was the 14 January 2022, M=6.6 Banten earthquake. The recorded ground motions are subsequently used to evaluate the shear-wave velocity profiles of these locations using the site response analysis program DEEPSOIL. Different profiles are generated to represent different correlations between geotechnical and geophysical parameters, as well as different possible deep shear-wave velocity profiles generated from inverse analyses of geophysical survey results. The results are used to develop the likely shear-wave profiles and also to adjust the depth of engineering bedrock.

Widjojo A. Prakoso is a professor in geotechnical engineering at Universitas Indonesia. Widjojo received his bachelor's degree in in civil engineering from Universitas Indonesia in 1993. He received his master's degree and his Ph.D. in geotechnical engineering from Cornell University, USA in 1999 and 2002, respectively. After working for a geotechnical engineering company in New York City as a senior geotechnical engineer, he started his academic career as an assistant professor at Universitas Indonesia in 2003, where he is currently a full professor. He has a great interest in engineering education, and is actively involved in many related activities. His research interests are foundation engineering, geotechnical earthquake engineering, and risk-based based geotechnical engineering, and he has published more than 120 technical articles. He serves as the president of the Indonesia Society for Geotechnical Engineering in 2019-2023, and he serves as a member in several government review panels. Widjojo is also a certified geotechnical engineer.

Ethics and Dilemma in Engineering

Ikuo Towhata
Kanto Gakuin University ✉ towhata.ikuo.ikuo@gmail.com

Engineering ethics is one of the key issues in the modern technology and is often discussed in the civil engineering community nowadays. It is frequently stated in this context that engineers have to respect the welfare and safety of the public by correctly using their knowledge and experiences. In reality, however, there are many situations in which such a simple motto does not work well. In contrast, there are cases in which engineers suffer from a dilemma or conflict of two ethical requirements such as "which is more important, welfare of people or safety of people?". In the most difficult situation, an ethically correct action is not accepted by the public because it is not verified scientifically, although scientific verification is impossible. This means that an engineer's empirical judgment is not respected. It is a pity that most discussion on engineering ethics only describes the problems and cannot propose what engineering action is correct from an ethical viewpoint. The present paper picks up several cases in which an ethical conflict posed problems to engineers or a conflict occurred between science and technology (logical thinking versus empirical judgement), that led to a catastrophic consequence. Under the latter theme, it is important that human knowledge on nature is never sufficient and that, if so, scientific judgment is impossible.

Ikuo Towhata was a Professor of Civil Engineering, at University of Tokyo from 1994 to 2015. He received his bachelor, master and doctoral degrees of engineering at the Civil Engineering Department, University of Tokyo. After his doctoral degree, he stayed in the University of British Columbia as a post-doctoral fellow and then served as an Assistant Professor at the Asian Institute of Technology in Bangkok. His major fields of study have been related mostly with the geotechnical earthquake engineering such as numerical response analysis, liquefaction consequence, and coseismic landslides. After 2015, he became a Professor Emeritus and continued working for private firms on architectural design and also on geotechnical consulting. His recent achievements concern about early warning of rainfall-induced landslides, value of subsurface investigation in construction projects and social aspects of geotechnical engineering in addition to the issues in conventional geotechnical discipline. He stayed for five months in the Indian Institute of Technology (IIT) Bombay, India, as well as IIT Hyderabad for several weeks and also spent two months at Budapest University of Technology and Economics in order to make greater international relationships. It is important in this connection that he was the Vice President for Asia of the International Society for Soil Mechanics and Geotechnical Engineering from 2013 to 2017. His recent international activities include reconnaissance studies after the earthquakes in Sulawesi of Indonesia in 2018 and South Turkey in 2023. He is delivering keynote and invited lectures at numerous international conferences including ICSMGE in Osaka, 2007 and the TC203 Ishihara Lecture in 2019 in Rome. Last but not least, he authored an encyclopedia book "Geotechnical Earthquake Engineering" published by Springer in 2008 and, more recently, was the Chief Editor of another book "Coseismic Landslides: Phenomena, Long-term Effect and Mitigation" published by Springer Nature in 2022.

Innovative Climate-Smart Nature-Based Technology for Slope Protection

Mohammad Shariful Islam
Bangladesh University of Engineering and Technology ✉ msharifulbd@gmail.com

Because of the unique geological location of Bangladesh and its climate, riverbank and char-island erosion, coastal and road embankment failure and landslides occur continuously throughout the country. The Vetiver application is a recognized nature-based solution to these challenges. Although there were significant studies on Vetiver Grass Technology (VGT), the existing literature had many research gaps in the sector of appropriate design, construction processes, and contracting methods considering soil and geo-environmental variables. In this context, the research works conducted by the author include Vetiver growth on soil treated with different stabilizers in diverse contexts, mechanical and hydraulic characteristics, numerical and mathematical analysis of rooted soil, incorporation of IoT in VGT, etc. Numerous model and pilot studies were conducted in different contexts. Based on that, this method has been incorporated into several types of infrastructure, such as road embankments, land reclamation, char protection, etc., at different geographical locations in several local and global projects with the collaboration of various government and international organizations and funding agencies. This technology has both success and failure stories, but more importantly, it has succeeded in many adverse situations, such as against wave action, submerged conditions, salinity, etc. Moreover, it has been proven to be very cost-effective compared to other conventional methods for slope protection. Because of these, the Vetiver scheme has been included in the procurement schedules of different government departments. The research findings have been disseminated through workshops, presentations, trainings, reports, knowledge products, and technical articles in top-ranked journals and covered in various local and international print and electronic media. Some challenges have been identified that are hampering the spreading of this technology, including a lack of knowledge, motivation, and awareness among practicing engineers and the local community. To overcome these challenges, proper sharing of the existing knowledge base and skill training, incorporation of local community-based activities and e-marketing platforms,

preparation of detailed standards and rate schedules, and efficient and compatible contracting methods need to be ensured. Moreover, funds for appropriate research and multi-disciplinary collaboration will help in developing comprehensive guidelines and construction methodology in this sector. VGT is not only effective for erosion control, but this technology will also reduce the overall temperature by evapotranspiration and absorb carbon from the environment and deep soil by carbon sequestration, which aligns well with the Paris Agreement and the SDGs. So, it can be concluded that VGT is a climate-smart alternative for slope protection.

Mohammad Shariful Islam is currently working as a professor at the Department of Civil Engineering, BUET. He is also an adjunct faculty member at Chandigarh University, India. His research specialization focuses on various state-of-the-art topics, including bioengineering, climate-resilient infrastructure, disaster-resilient rural housing, land reclamation, constitutive modeling of soil, etc. He has made significant contributions in the fields of Vetiver-based bioengineering, disaster-resilient infrastructure, and green bricks. These have been implemented in different projects in Bangladesh by government agencies and international agencies (ADB, EU, IFAD, IOM, SIDA, UNCDF, and UNDP) for road projects in Cambodia and Indonesia. Dr. Islam has published 170 research articles in reputed journals, conferences, and seminars and has given more than 25 keynote/invited lectures at home and abroad. He received 17 awards for research excellence, which include Global Vetiver Champion Award 2023, Vetiver Network International Award 2023, FORUM86 Research Excellence Award 2020, King of Thailand Vetiver Awards 2015, Vetiver Network International Award 2015, and the Best Paper Award from Springer Nature, ISSMGE, and JSCE. Besides, he received nine awards for academic excellence, which include Dr. Rashid Gold Medal, Sharfuddin Gold Medal, Dean's Award, Monbusho Scholarship (Japan), and university merit scholarships. He is conducting and collaborating on different research projects with local and global partners. Dr. Islam is dynamically contributing to national development by working as a member of a panel of experts or consultants on different important mega projects for elevated expressways, submarine bases, airports, seaports, bridges, highways, railways, etc. in the country.

Overview on Ground Treatment Design for Electrified Double Track in Northern Part of Peninsular Malaysia

Peir-Tien LEE
Malaysian Geotechnical Society
leepeirtien@yahoo.com

The construction of a electrified double track (about 200 km) for northern part of Peninsular Malaysia commenced in year 2007. As the railway track transverses from north to south, the subsoil consists of various types of soil ranging from soft alluvium deposit to dense residual soil. The geometrical tolerenace of railway track is generally very stringent, especially at high operating speeds. Hence, various cost effective ground treatment designs meeting the design performance and construction schedule are required especially when long stretches of the embankment structure supporting the tracks are traversing through soft alluvium deposits wih thickness of 15 m to 20 m. Ground treatment techniques such as excavate & replace (E&R), prefabricated vertical drain (PVD), temporary surcharge, basal reinforcement, stone column and piled embankment were designed to meet the stringent performance requirement of differential settlement of not more than 10 mm over a chord length of 10 m and settlement of not more than 25 mm within 6 months after completion. In addition, different from normal highway embankment, dynamic effect checks is vital to determine the safe configuration of the railway embankment in order to prevent excessive subgrade deformation and failures due to repetitive axle load. Hence, the adopted design methodology such as settlement analyses, stability analyses and dynamic effect check will be presented. The presentation will also highlight the usage of piled embankment with different lengths as transition area to provide smooth profile between bridge abutment (rigid structure with pile to set) and embankment area (no pile area). In addition, the presentation will also share the usage of conventional sand drain as replacement to PVD for area under existing pylon, some lesson learnts and good construction practices.

Temporary surcharge

PVD installation

Peir-Tien LEE obtained his Bachelor of Engineering (Civil) from University of Technology, Malaysia in 2001. He has been involved in design and construction of various geotechnical specialist works for the past 20 years.

He involved in several major infrastructure projects in Malaysia such as Kajang Dispersal Link Road (SILK), Electrified Double Track (Padang Renggas to Alor Setar), KVMRT Line 1, East Coast Rail Link (ECRL), KL – Singapore High Speed Rail (HSR) and Southern Double Track (Gemas to Kluang) etc. He also involved as the main designer in several reclamation projects such as Penang World City, Melaka Gateway, Penang South Reclamation, Butterworth reclamation etc.

He has published more than a dozen of technical papers on geotechnical engineering in international and local conferences. His research interests include soft ground engineering, slope stabilisation, foundation and deep excavation.

He was the Chairman for Geotechnical Engineering Technical Division (GETD) of IEM for Session 2017/2018 and 2018/2019. He also actively involved in Malaysian Geotechnical Society (MGS). He was the Committee Member from 2016 to 2020, the Secretary General for Session 2020/2021 and Deputy President for Session 2021/2022. Currently, he is the President of MGS for Session 2023/2024.

Towards to Harmonizing Using of the Probabilistic Seismic Hazard Assessment Results in Seismic Codes

Pulod Aminzoda
Institute of Geology, Earthquake Engineering and Seismology,
National Academy of Sciences of Tajikistan ✉ p.aminzoda@gmail.com

The lessons of Turkey, February 2023 major earthquakes are very important for Tajikistan, territory of that is related to high seismically active zone and where in the past 100 years a number of strong and major earthquakes have occurred.

The analysis of the catastrophic consequences of the Turkey, February 2023 earthquakes showed that one of the reasons of that was the absence of necessary response of authorities to new seismic hazard map, presented in Turkish seismic codes, 2018 and, evidently the misunderstanding of new map using in design practice. This fact became the basis for the investigation of ensuring by the Tajikistan current seismic codes the specified level of earthquake resistance of buildings and structures.

For this purpose, the worked by IGEES new probabilistic seismic hazard map has been used. The main approach adopted in the research calculations is to use the position of some regulatory documents, that in a case of earthquake with return period of 475 years the appearance of negligible damages in bearing elements of structure is allowable, i.e. structure is working in elastic stage.

Based on said approach the research calculations for more than 30 high-rise monolithic reinforced concrete buildings of Dushanbe city have been conducted using LIRA SAPR software. Research calculation results were compared with the seismic codes-based calculation results. According to investigation, the design reinforcing of structural elements of building, which is an integral indicator of stress-strain state of structure, according to PSHA based calculation results are up to 1.5-3 times lower in comparing with the codes-based calculation results.

In turn, this indicates on the sufficient conservativeness of the current seismic codes of Tajikistan in terms of ensuring seismic stability of buildings and structures being constructed in country, and shows on perspectives for the possible optimization the current seismic codes.

Pulod Aminzoda is a Director of Institute of Geology, Earthquake Engineering and Seismology of the National Academy of Sciences of Tajikistan.
He has graduated the Tajik Polytechnical Institute, Industry and Civil Engineering Department in 1982. Starting this year up to present he is working in Institute of Geology, Earthquake Engineering and Seismology, NAST (former Institute of Earthquake Engineering and Seismology of the Academy of Sciences of the Republic of Tajikistan) at different research positions.
In 1984-1987, he graduated the Earthquake Engineering Department of Central Research Institute for Building Constructions of USSR State Committee for Building in Moscow where in 1988 defended the Ph.D. thesis entitled "Consideration of ground's inertial properties in seismic design".
The main research interests of Dr. Aminzoda are: assessment and providing the seismic stability of buildings and structures, strong motion data processing, analyzing and using in practice, seismic vulnerability and seismic risk assessment, rehabilitation and retrofitting of structures damaged under seismic excitations and soil subsidence, structural designs of buildings and structures by utilizing the probabilistic seismic hazard analysis results in design practice, development of national and regional seismic and other codes.
Pulod Aminzoda is the executive President of Tajikistan Geotechnical Society, member of the Academy of Architecture and Construction of Tajikistan, International Association of Experts in Earthquake Engineering (Kyrgyzstan), Eurasian Seismo Association (Russia).
In the last years, Pulod Aminzoda as the national expert has participated in different regional and international projects such as Lake Sarez - Risk Mitigation Project, Monitoring and technical assistance of projects, funded by Japan's Grant Assistance for Grassroots Human Security Projects, School Safety Initiative Project, Earthquake Modeling for Central Asia (EMCA – GEM), Technical and Economic Assessment Studies for Rogun HPP Project, Institutional cooperation on earthquake risk reduction between Norway, Kyrgyzstan, Uzbekistan, and Tajikistan, Seismic network extension in the Caucasus and Central Asia (SNECCA) and others.
He is the author of more than 50 publications and participated in more than 40 international and regional scientific-practical events.

Innovation in Geotechnical Engineering from Soil Mechanics to Geotechnical Engineering

Amjad Agha
Pakistan Geotechnical Engineering Society
aceron@brain.net.pk

The Geotechnical Engineering has been a dynamic part of the Civil Engineering Profession. Initially it emerged as Soil Mechanics and became prominent in the fifties due to research work by eminent Professionals like Kail Terzaghi, Arthur Casagrande and other experts. The subject of Soil Mechanics thus progressed as Soil Mechanics and Foundation Engineering. Later it was felt that when dealing with Foundations, it is necessary to have a good knowledge of Geology. Subsequently engineering geology and earthquake engineering also became parts of this subject, and Soil Mechanics/Foundation Engineering was redesignated as Geotechnical Engineering.

By combining the knowledge of these subjects the Geotechnical Engineering profession further progressed and became an important component of Dam Engineering. The research work became more dynamic and the appearance of shear zones in the over consolidated clays were discovered which brought the knowledge of Residual Strength of such materials. Similarly reason of failures in the saturated sandy material subject to shaking i.e. the Liquefaction phenomenon became known and their solutions were devised. The earthquake intensity was researched, and the use of Maximum Credible Earthquake (MCE) and appreciation of various intensities of Earthquake were identified. New innovations in Geotechnical Engineering help the Engineering profession to improve the safety of structures built on various types of foundation materials. It should however be remembered that it is not possible to determine the exact properties of a foundation, and the failures can still occur. Therefore, for geotechnical engineer, it is very important to remain updated on knowledge of precedents.

In my talk, I will discuss about these innovations and also my experience in using this research in the design of dams, water retaining structure, and buildings etc.

Amjad Agha is a graduate in Civil Engineering from Peshawar University and pursued his post graduate studies at Columbia University New York and Princeton University, N.J, USA. His main interest has been in the Geotechnical Engineering and he is the leading expert in Dam Engineering in the Country. He has followed the profession of Engineering Consultancy and has held various high positions in his career as well as in the profession, starting from his current position as follows:

President and Member pf Board of Directors of Associated Consulting Engineers, oldest Private Sector Consulting Company in Pakistan with 1000 employees (2005–todate).

Chief Executive Pakistan Hydro Consultants, a multi-national joint venture, engaged to design and supervise the construction of Ghazi Barotha Hydropower Project. A 2.5-Billion-dollar project, financed by World Bank, Asian Development Bank, and other international donors (1995–2004).

President / Managing Director of National Engineering Services (NESPAK) - the largest Consulting Engineering Company in Pakistan, over 2500 employees (1987–1995).

Before the above Chief Executive positions, Mr. Agha worked with NESPAK and WAPDA on various projects and positions.

In his professional capacity he occupied following high level positions. (a) President, Pakistan Geotechnical Engineering Society, (b) Life Member, American Society of Civil Engineers, (c) Fellow, Institution of Engineers Pakistan, (d) Executive Vice President, Federation of Consultants from Islamic Countries (FCIC), (e) Member, International Panel of Experts to advise on Mangla Dam Raising Project, (f) Member, International Panel of Experts to advise on Basha Dam Project, (g) Chairman, Panel of Experts for Malakand-3, Hydropower Project.

Mr. Agha has widely travelled, attended and chaired national and international technical conferences and authored over 40 technical and professional papers.

Case Studies - Forensic Study of Foundation Failures and Monitoring Impact during High-Rise Demolition

Anil Joseph
Geostructurals Pvt. Ltd.
aniljoseph@geostructurals.com

Forensic civil engineering is "The investigation of materials, products, structures or components that fail or do not operate or function as intended, causing personal injury or damage to property". The presentation depicts two case histories of forensic geotechnical engineering and a case study of vibration monitoring to analyze the effect on neighboring build environments using delayed detonation techniques to demolish high-rise structures. In case study one, the analysis and review of a touch pile system failure during deep excavation for a commercial building (3 basements, ground floor and eight floors) is described. Excavation to a depth of 10 m from ground level was required to reach up to the foundation level of the structure and to retain soil to facilitate the excavation; a retaining wall was formed using touch pile systems supported with strutting. As the excavation was in progress, the shoring system collapsed. The forensic study found that the strutting system was inadequate to take up the lateral thrust from the touch piles, and soil at the dredge line has turned out to be very soft and has caused considerable loss of strength at the interface. The subsequent increase in the unsupported length of the piles is also a reason for the failure of the retaining system. Case study 2 discusses the details of the rectification process of a tilted pier in the Kochi Metro rail. After a thorough inspection of pillar no.347, a tilt on the track above the pillar and a minor gap between the viaduct and the track were observed. Further inspection revealed a tilt in the Pier cap, Pier and Pile cap. The forensic investigation found that the differential settlement of piles due to soft toe formation was the root cause of the problem. Four additional piles embedded in the hard rock strata were added to strengthen the pillar foundation. Underpinning the existing pile cap with the new piles were carried out to stabilize the foundation system. Case study 3 discusses monitoring vibration impact on neighboring structures during the demolition of high-rise buildings by implosion. Implosion or explosion deconstruction is an efficient and cost-effective method for safely bringing down multi-story structures by strategically placing explosives and timed detonation causing the building to collapse under gravity, minimizing the damage to surroundings. The Supreme Court

ordered the demolition of Supertech Twin Towers, Noida, as it violated minimum distance requirements and lacked consent from nearby flat owners. Pre and post demolition, rapid visual assessments were conducted on neighboring structures to understand the impact of demolition by implosion. Ground vibrations during demolition were monitored using accelerometers and geophones, and the readings showed peak particle velocity within the acceptable limit. The crack meters placed showed very minimal impact.

Anil Joseph is the President of Indian Geotechnical Society and also the Managing Director of Geostructurals (P) Ltd. a leading foundation & structural consultancy firm based at Cochin. He has provided foundation and structural consultancy for more than 3000 High rise structures including many land mark multistoried and Infrastructure projects in India and abroad in the last 30 years. His design of Nippon Toyota showroom at Kalamassery, Platynum Mall at Maradu, Lulu Grand Hyatt Hotel & Convention Centre, Bolgatty Island, Kochi, has won the ICI - UltraTech Award for Outstanding Concrete structures of Kerala in the building category in the year 2012, 2017 and 2018 respectively. He is the Managing Director of CECONS (P) Ltd. a construction firm specialized in the execution of pile foundations and also the Director of Engineers Diagnostic Centre (P) Ltd. a firm specialized in Geotechnical investigation and Retrofitting works.

He is a National Council Member of Institution of Engineers India in Civil Division for the term 2021 to 2025. He is the Governing Council member of Indian Association of Structural Engineers. He is also the Chairman of Indian Concrete Institute, Kochi Center, Vice Chairman of Builders Association of India, Cochin Chapter and Governing Council member of Builders Association of India. He is the Immediate past President of Association of Structural and Geotechnical Consultants, Kerala, Immediate Past State President of Graduate Association of Civil Engineers, the Past President of Association of Piling Specialists, Kerala, Member of Association of Contracting Engineers, Executive Committee Member of Deep Foundation Institute India, Managing Committee Member of Kerala Management Association and an adjunct faculty of Albertian Institute of Science & Technology, Cochin. As per the direction of Supreme Court, it was decided to raze 5 high rises at Maradu, Cochin and Dr. Anil Joseph was appointed as the Geotechnical and Structural expert in the technical committee by the Govt of Kerala in the year 2019. Dr. Anil Joseph is also involved in various social activities such as Vice President of the Regional Sports Centre, Kadavanthara, Cochin, He is an active Rotarian and was the Former Assistant Governor of Rotary District 3201 and past president of Rotary Club of Cochin Downtown. He was one among the top 10, Diamond Hall of Fame, New Age Icon Change Makers 2020.

Crack Patterns of Unbonded Post-Tensioned Members and Seismic Retrofitting Techniques Using CFRP

Uksun Kim
California State University, Fullerton
ukim@fullerton.edu

In high-seismic areas such as California, damage and collapse of buildings due to earthquakes have always been a major concern. Therefore, lots of research has been conducted to mitigate seismic hazards through government agencies, professional organizations, and universities. Especially, the demand to secure the seismic safety of the unbonded post-tensioned building system is increasing in California because unbonded post-tensioned members are widely used in parking structures. In this research, the crack patterns of unbonded post-tensioned members, such as beams (single-span and two-span beams) and slabs (one-way and two-way slabs), were experimentally investigated. Based on these experimental results, effective repair and retrofitting methods using CFRP (Carbon Fiber Reinforced Polymer) are proposed.

Uksun Kim is a Professor of Civil and Environmental Engineering at California State University – Fullerton. He received his B.S. degree in Architectural Engineering from Yonsei University (Seoul, Korea). He has two M.S. degrees. One is from Yonsei University in the field of Architectural Engineering, and the other is from Michigan State University (East Lansing, MI, USA) in the field of Civil Engineering. He earned his Ph.D. with an emphasis in structural engineering from the School of Civil & Environmental Engineering at the Georgia Institute of Technology (Atlanta, GA, USA).

He has more than 30 years of experience working on experimental and analytical investigations of building structures, both at a research institute in Korea and at universities in the US. He carried out many research projects successfully, such as the development of light-gauged steel frame housing, seismic design of steel joist girder structures, seismic rehabilitation of prestressed building systems, etc. For his outstanding accomplishments in teaching and research, he received the "2014 Outstanding Engineering Educator Award" from the Orange County Engineering Council and the "2016 Distinguished Faculty Member in ECS (College of Engineering & Computer Science)" from CSUF (California State University-Fullerton).

He is a licensed professional engineer and a LEED AP (Leadership in Energy and Environmental Design Accredited Professional). And, he served as the Department Chair from 2012 to 2018.

Structuring Shear Wall Buildings Based on Artificial Neural Networks

Leonardo Massone
University of Chile
✉ lmassone@uchile.cl

Residential reinforced concrete building design relies on close collaboration between architectural and engineering offices to improve the distribution of living spaces while meeting structural regulatory requirements. Several studies have taken advantage of the vast amount of data generated by both offices to create machine-learning models that streamline design processes and decision-making. Recent research proposed an artificial neural network (ANN) model for predicting the length and thickness of the rectangular segments that constitute the plan's walls based on the architectural data; however, it couldn't predict walls absent from the original design. This constraint was addressed by a convolutional neural network (CNN) model, demanding a larger dataset (by 137 times) and several rule-based filters for assembling the predicted plan, incurring high computational costs, and generating blurry predictions. Therefore, this study presents the previous and a new methodology to propose walls and columns that were not considered in the architectural design through an ANN model, which employs fewer data than the CNN but with comparable results.

Leonardo M. Massone is a Professor at the University of Chile and Technical Manager at IDIEM from the same University. He received his BS degree from the University of Chile, and his MS and Ph.D. degrees from the University of California, Los Angeles. He teaches concrete design, advance concrete design and nonlinear analysis of structures classes. His research interests include analytical and experimental studies of reinforced concrete systems, with emphasis on seismic response. He has written more than 60 articles indexed in WoS (Web of Science). He has received both national recognition, such as from the Chilean Institute of Engineers (2014), and international recognition, such as the "Young Professor Best Paper Award" for the 36th Conference on Deep Foundations (USA, 2011), "Best Paper Award" for the 10th International Congress on Advances in Civil Engineering, (Turkey, 2012) and for the Structural Design of Tall and Special Buildings journal (USA, 2017). He was Director of the Civil Engineering Department between 2014 and 2018 and since 2023 is technical manager at IDIEM. He was a voting member of an ACI 318 sub-group for the 2019 version and is currently the coordinator for the update of the Chilean design code for reinforced concrete structures, NCh430.

Integrating Machine Learning into Building Codes: Establishing Equivalence through Causality and Intuition

M.Z. Naser
Clemson University
mznaser@clemson.edu

The traditional approach to formulating building codes is often slow, labor-intensive, and may struggle to keep pace with the rapid evolution of technology and domain findings. Overcoming such challenges necessitates a methodology that streamlines the modernization of codal provisions. This seminar proposes a machine learning (ML) approach to append a variety of codal provisions, including those of empirical, statistical, and theoretical nature. In this approach, a codal provision (i.e., equation) is analyzed to trace its properties (e.g., engineering intuition and causal logic). Then a ML model is tailored to preserve the same properties and satisfy a collection of similarity and performance measures until declared equivalent to the provision at hand. The resulting ML model harnesses the predictive capabilities of ML while arriving at predictions similar to the codal provision used to train the ML model, and hence, it becomes possible to adopt in line with the codal expression. This approach has been successfully examined on seven structural engineering phenomena contained within various building codes, including those in North America and Australia. Our findings suggest that the proposed approach could lay the groundwork for implementing ML in the development of future building codes.

M.Z. Naser is a professional engineer and an assistant professor at the School of Civil and Environmental Engineering and Earth Sciences at Clemson University and a faculty member of the AI Research Institute for Science and Engineering (AIRISE). Dr. Naser serves as the current chair of the American Society of Civil Engineers (ASCE). Advances in Information Technology (AIT) committee and a voting member of various national and international engineering institutions. Dr. Naser's research creates causal and explainable machine learning methodologies to help us realize functional, sustainable, and resilient infrastructure. He has co-authored over 140 peer-reviewed publications, including a new textbook on machine learning and civil engineering, titled "Machine Learning for Civil and Environmental Engineers: A Practical Approach to Data-Driven Analysis, Explainability, and Causality" by Wiley. He is listed in the company with the world's most impactful researchers by Elsevier and Stanford University, ranking among the world's top 2% of scientists for two constitutive years (2022-2023). Outside of his research interests and teaching activities, Dr. Naser most enjoys spending time with his wife and family, and when time permits, his favorite hobbies are hiking and working out.

Study on Failure Modes and Load-Carrying Capacity of a Transmission Tower

Seungjun Kim
Korea University
rocksmell@korea.ac.kr

Transmission towers are classified as the lattice structure which consists of main posts, horizontal members, and braces. Although many large-scale infrastructures are being designed based on the load and resistance factor design (LRFD) method, the high-rise lattice structures have been designed through the allowable stress design (ASD) method in Korea. The Korean Society of Steel Construction (KSSC) research team was funded by the Korea Electric Power Research Institute (KEPRI) to develop the LRFD-based design specification in 2021. Conducting the project, we have investigated the ultimate behavioral characteristics of the transmission towers. As well as the nonlinear finite element analysis, we conducted the full-scale experiment of the tower. The experiment's objectives are to study the feasibility of the developed LRFD-based design specification and investigate the failure modes and load-carrying capacity. According to the experiment, the structure can show buckling of main posts owing to the unbalanced forces induced by line breaks and strong winds. In this presentation, I show the details of the failure modes, load-carrying capacities, and critical load combinations.

Seungjun Kim, an associate professor at Korea University, received the bachelor´s degree in civil engineering from Korea University, Seoul, South Korea in 2004, the M.S. degree in structural engineering in 2006, and the Ph.D. degree in structural engineering from Korea University in 2010. He worked as a postdoc research associate at Texas Transportation Institute and Texas A&M ocean engineering division from 2012 to 2014. In 2014, he joined Samsung Heavy Industries as a senior researcher. In the company, he has conducted many projects to develop the effective design and analysis method for very large offshore oil&gas platforms. He worked at the department of construction safety and disaster prevention engineering at Daejeon university from 2016 to 2019. Then, he finally joined the school of civil, environmental and architectural engineering at Korea University as an assistant professor.
Dr. Seungjun Kim is the director of the structural system laboratory of Korea University. The main research interests are innovative numerical simulation, development of advanced offshore floating systems including renewable energy facilities, AI-based smart structural monitoring technologies, and effective construction safety technologies. He has published more than 70 SCI(E) indexed papers for structural engineering.

Impact Performance of Reinforced and Post-Tensioned Concrete One-Way & Two-Way Members

Thomas Kang
Seoul National University
tkang@snu.ac.kr

In this presentation, the impact performance of reinforced and post-tensioned concrete one-way & two-way members will be dealt with in the perspective of forensic engineering. First, new energy-based models for the prediction of high-velocity and low-velocity impact performances of one-way members will be briefly introduced. A lack of specific data regarding the high-velocity and low-velocity impact performances such as those for post-tensioned members, two-way members, etc. is identified from the comparison between the existing test database and the prediction of penetration depth, residual velocity, and maximum deformation. To bridge the gap, new high-velocity impact tests and drop-weight low-velocity impact tests on unbonded post-tensioned two-way members, which have not been investigated by previous studies, are being conducted and will be presented. The effect of prestressing on the impact performance has been noted and the observed damage patterns and response mechanisms can be used in forensic investigating. Finally, numerical analyses conducted to predict the behavior of the test specimens and untested specimens will be explained, along with the related ongoing and future study.

Thomas Kang is a professor in the Department of Architecture & Architectural Engineering at Seoul National University (SNU), Korea. Before that, he was a professor in the School of Civil Engineering and Environmental Science at the University of Oklahoma and a Licensed Professional Engineer in the State of California. He also has held various affiliated positions in the U.S., Japan and South Africa, including UCLA, University of Illinois at Urbana-Champaign, University of Hawaii at Manoa, University of Tokyo and University of Cape Town. Prof. Kang received his Ph.D. from UCLA, his MS from Michigan State, and his BS from SNU.

He is a Fellow of Post-Tensioning Institute (PTI) and American Concrete Institute (ACI), and a member of National Academy of Engineering of Korea and Korean Academy of Science and Technology, as well as a member of EU Academy of Sciences.

He received several prestigious awards, including the Kenneth B. Bondy Award for Most Meritorious Technical Paper as Lead Author from PTI in 2012 and 2023, the Wason Medal for Most Meritorious Paper as Lead Author from ACI in 2009, and the Martin P. Korn Award as Responsible Author from PCI (Precast/Prestressed Concrete Institute) in 2023. He currently serves as an Editor-in-Chief for the Journal of Wind & Structures and as the Associate Editor for the PTI Journal. Prof. Kang has published over 175 international journal papers, including over 55 in ACI Structural Journal, over 15 in ASCE Journal of Structural Engineering, and over 15 in PTI / PCI Journals. His research interests include the design and behavior of reinforced, prestressed and post-tensioned concrete structures, as well as dynamic effects (wind, seismic, fire and shock) on structures.

Advancing Roller-Compacted Concrete Pavements for Heavy-Load Container Terminals: A Study on Optimizing Structural Design under Increased Stacking Pressures

Emin Sengun[1], Sunghwan Kim[2], Halil Ceylan[2]
Ankara Yildirim Beyazit University[1], Iowa State University[2] ✉ esengun@aybu.edu.tr

This study explores the advancement of Roller-Compacted Concrete (RCC) pavement structural designs in container terminals, addressing the increased stress challenges due to higher stacked container loads. Traditional container storage areas have utilized diverse paving materials, including gravel, concrete beams, asphalt, and pavers. However, the recent practice of stacking containers up to eight levels has dramatically increased pavement surface stress, heightening the risk of rapid degradation. This study employs finite-element software to identify container loading configurations causing maximum stress and deformation, a vital step for devising robust RCC pavement structural designs for such high-load situations. Through comprehensive parametric analysis, it offers insights into the effects of various subgrade reactions, material strengths, and stacking heights. It also introduces transfer functions to calculate the minimum thickness needed for RCC pavements under these conditions. This research marks a significant contribution towards a detailed structural design guide for RCC pavements, tailored for the unique demands of modern stacked container storage in container terminals.

Emin Sengun, serving as an assistant professor at Ankara Yildirim Beyazit University, has an educational background in civil engineering. His academic achievements began with a bachelor's degree in civil engineering, earned with high honors from Yildiz Technical University, Istanbul, Türkiye, in 2010. He then continued his studies at Istanbul Technical University, earning an M.S. in Soil Mechanics and Geotechnical Engineering in 2013. In 2019, Dr. Sengun received his Ph.D. in the Construction Materials Division from Middle East Technical University (METU), where he was awarded the METU Graduate Award – Ph.D. Award for Contributing to Technological Development.

Following his doctoral studies, Dr. Sengun was granted a postdoctoral research scholarship from The Scientific and Technological Research Council of Türkiye (TUBITAK). He furthered his research as a research scholar at Iowa State University's Program for Sustainable Pavement Engineering and Research (PROSPER) from 2022 to 2023. During his research term, he collaborated with the Roller-Compacted Concrete (RCC) Research Council in the US, focusing on developing a design methodology for engineers to design RCC pavements for stacked container terminals. Dr. Sengun's primary research interests include concrete pavement technology, pavement design, and material characterization. He has authored over 30 peer-reviewed indexed papers, demonstrating his significant contributions and expertise in his field.

Sunghwan Kim, P.E., is an Associate Director of the Program for Sustainable Pavement Engineering and Research (PROSPER) and a Research Scientist at the Institute for Transportation at Iowa State University (ISU). He also serves as Adjunct Assistant Professor at the ISU Civil, Construction, and Environmental Engineering (CCEE) Department. Dr. Kim holds a Bachelor of Science degree (Korea University 1999), a Master of Science degree (Iowa State University 2004), and a doctorate (Iowa State University 2006), all in civil engineering. His credentials are further enhanced by a Professional Engineering (PE) license from the State of Michigan.

Dr. Kim's career is distinguished by his significant contributions to transportation and geo-infrastructure engineering. At ISU, he has played a pivotal role in over 40 competitively funded research projects, attracting more than $14.5 million in project funds, where he served as co-principal investigator and in 16 research projects as a technical specialist, focusing on both paved and unpaved road systems and their construction materials. His prolific academic output includes authoring and co-authoring over 250 peer-reviewed technical publications, encompassing more than 95 journal articles and over 100 conference papers, and presenting more than 140 technical presentations in the realm of pavement/geosystem and transportation infrastructure engineering. Dr. Kim's expertise and dedication to his field have been recognized with several awards, including the 2020 FAA PEGASAS Jimenez Faculty/Researcher Award and the 2021 ISU Professional and Scientific Excellence Award, among others, underscoring his substantial impact on pavement engineering and transportation infrastructure system research.

Halil Ceylan, Dist.M.ASCE, is a Pitt-Des Moines, Inc. Endowed Professor specializing in Transportation Geotechnical/Materials Engineering and Intelligent Infrastructure Engineering in the Department of Civil, Construction, and Environmental Engineering (CCEE) at Iowa State University (ISU). Dr. Halil Ceylan serves as the Founding Director of the Program for Sustainable Pavement Engineering and Research (PROSPER) at the ISU Institute for Transportation and the ISU Site Director for Partnership to Enhance General Aviation Safety, Accessibility and Sustainability (PEGASAS) Federal Aviation Administration (FAA) Center of Excellence on General Aviation. Prof. Ceylan holds a Bachelor of Science degree (Dokuz Eylul University 1989), two Master of Science degrees (Dokuz Eylul University 1993, University of Illinois at Urbana-Champaign 1995), and a doctorate (University of Illinois at Urbana-Champaign 2002), all in civil engineering. Since 2002, Prof. Ceylan has taught courses in pavement analysis and design, design of concretes covering portland cement concrete and asphalt cement concrete, geotechnical engineering, and senior design to as many as 3,000 undergraduate and graduate students.

Prof. Ceylan has extensive experience in the area of transportation/geo-infrastructure engineering and has pioneered innovative research and techniques for achieving "Smart, Sustainable, Durable, and Resilient Geosystems and Transportation Infrastructure Systems." Throughout his career, he has been involved with over 135 research projects, worth more than $25 million project funds, serving as the principal investigator or co-principal investigator; these projects have been sponsored by the Federal Aviation Association, Federal Highway Administration, National Cooperative Highway Research Program, National Science Foundation, Second Strategic Highway Research Program, Portland Cement Association, various state departments of transportation (DOTs) and research boards, including the Iowa DOT and Iowa Highway Research Board, among others. Prof. Ceylan has authored and co-authored over 420 peer-reviewed publications, including more than 155 journal articles, more than 170 conference papers, 6 edited books, 4 invited book chapters, and more than 75 technical reports, among others. He is a leader and an avid technical presenter, having delivered over 400 presentations, including 150+ invited talks and several keynote lectures, taught/organized over 15 short courses and workshop events, and presided over 45 technical sessions, tracks, and conferences, including serving as the organizing/conference chair or co-chair for three national/international level conferences. Prof. Ceylan has supervised/co-supervised more than 70 graduate students and more than 15 postdoctoral research associates, research staff, and visiting scholars from diverse and multicultural backgrounds. He has received over 25 awards, including the 2022 Class of ASCE Distinguished Member, the 2021 ASCE James Laurie Prize, and the 2022 University of Illinois Alumni Achievement Award.

System and Model Robustness for Hydrosystems in the Era of the Fourth Industrial Revolution

Donghwi Jung
Korea University
✉ sunnyjung625@korea.ac.kr

Robustness is defined as a system's ability to persist its functionality under disturbances. A robust water distribution system (WDS) should be able to provide consistently sufficient pressures under various conditions (e.g., fire flow and pipe break conditions). The identical global optimal solution could be found in different independent optimization trials by a robust metaheuristic optimization algorithm (MOA). This study reviews the state-of-the-art design, operational, and management approaches to improve hydrosystems' robustness. Reviewed studies range from robustness-based multiobjective optimal design of WDS, ensemble convolutional neural network for robust pipe burst detection, and robust scenario planning of urban drainage system to novel MOA and machine learning models for robust search and problem solving. Finally, strategies for improving system and model robustness are summarized to respond to the era of the fourth industrial revolution.

Donghwi Jung is an Associate Professor in the School of Civil, Environmental and Architectural Engineering, Korea University. Donghwi Jung received his Bachelor and Master's degree in Civil, Environmental and Architectural Engineering from Korea University in 2009 and 2011, respectively. In 2013, he received Ph.D. in Civil Engineering and Engineering Mechanics from University of Arizona.
His research interests lie in the interdisciplinary area of water system optimization, with particular emphasis on system resilience and robustness. The ultimate contribution of his work in this area is toward allowing hydrosystems (water distribution system, urban drainage system, etc.) to maintain their performance and to sustain the availability of water during and after natural and human-made disturbances (pipe bursts, population increases, and climate changes).

Advancing Real-Time In-Situ Environmental Monitoring Using Autonomous Unmanned Vehicles

Jae Hyeon Ryu
University of Idaho
jryu@uidaho.edu

The ongoing urban expansion, land use change, and economic growth continue to impact the water quality in Idaho's aquatic systems, including rivers, lakes, and reservoirs. While traditional methods of monitoring water quality play a significant role in informing the water community, there remains a need for further exploration to improve real-time monitoring and sampling of water quality for public safety. To address this, unmanned vehicle platforms, including unmanned aerial vehicles (UAVs) and unmanned surface vehicles (USVs) are being employed. These technologies are enhanced by cloud-based data sharing systems by utilizing Long-term Evolution (LTE) communication protocols. During the presentation, the author will demonstrate the advantages and disadvantages of these technologies and consider potential opportunities that could be applied to promote environmental stewardship by engaging citizen-scientists, thereby broadening their impact for public safety. Overall, the integration of UAV and USV platforms is poised to make a substantial contribution to environmental conservation and research in aquatic ecosystems in the forthcoming years.

Jae Ryu, Ph.D., P.E., is an associate professor of water resources engineering at the University of Idaho (UI). He received his Ph.D. in 2006 from civil and environmental engineering department at the University of Washington, Seattle. Since he joined UI as a faculty member, he also worked at the U.S. Air Force Academy (USAFA) to advance his research program using fast-moving technology, such as Unmanned Aerial System (UAS, also known as drone). He is the founder of Idaho Drone League (iDrone) and Interstate Drone League (iDrone National) to stimulate America youth (6th – 12th grade students) by learning basic concepts in automatic control, robotics and UAS system. Dr. Ryu hosted iDrone Summer Camp (iDrone Camp) offline to catalyze a hands-on STEM-based learning across Idaho since 2018. He continues to offer hands-on drone camps online (iDrone Online) via virtual e-learning platforms since the global pandemic (COVID-19). For more information, please visit at: *https://www.idroneprogram.org.*

Artificial Electric Field Algorithm for Training Multilayer Perceptron Models

Anupam Yadav
Dr. B. R. Ambedkar National Institute of Technology Jalandhar ✉ anupam@nitj.ac.in

Artificial Electric Field Algorithm (AEFA) is a recent metaheuristic which is inspired from the electrostatic force theory. In this algorithm the candidate solutions are considered as charged particles which can move under the influence of an artificially generated electric field. The fundamental concept of the attraction and repulsion of charged particles plays a major role to put an intelligence into these charged particles. This artificially created intelligence can be harnessed and many real-life challenging problems can be solved using this algorithm. There are many variants of AEFA available in the literature to address different types of optimization problems such as constrained, unconstrained and combinatorial optimization problems etc. Training multilayer perceptron model requires an optimal value of weights and bias, some times gradient based optimization algorithm do not yield an optimal parameter value which results in a poor training of the model. To overcome this issue the use of metaheuristics for training neural networks is becoming very popular. In particular AEFA is used for training multilayer perceptron models on several real-life data sets and the results are found very good and better than other heuristics methods and gradient based optimizers. The promising results of AEFA for training multilayer perceptron models gives a good scope for its application in other areas such as civil and environmental engineering problems.

Anupam Yadav is an Associate Professor at the Department of Mathematics, Dr. B. R. Ambedkar National Institute of Technology Jalandhar, India. His research area includes numerical optimization, soft computing, and artificial intelligence, he has more than ten years of research experience in the areas of soft computing and optimization. Dr. Yadav has done Ph.D. in soft computing from the Indian Institute of Technology Roorkee and he worked as a research professor at Korea University. He has published more than twenty-five research articles in journals of international repute, has published more than fifteen research articles in conference proceedings. Dr. Yadav has authored a textbook entitled "An introduction to neural network methods for differential equations. He has edited several books which are published by AISC, LNDECT Springer Series. Dr. Yadav have been the General Chair, Convener and member of the steering committee of several international conferences. He is a member of various research societies.

Artificial Intelligence for Advancing Water Treatment Research and Development

Nurul Alvia Istiqomah
Universitas Gadjah Mada
nurulalviaistiqomah@ugm.ac.id

Advancing research and development in water treatment is essential for securing the water, energy, and carbon (WEC) lifeline. However, the acquisition of clean water can be energy-intensive and can impact carbon emissions. Therefore, achieving sustainability in the WEC lifeline needs innovative approaches that go beyond traditional methods to enhance the water infrastructure performance. The dynamic growth in water treatment research underscores the potential of artificial intelligence (AI) in extracting valuable insights from published data. Unlike traditional models facing challenges in handling complex non-linear relationships, AI offers an effective approach by learning from the data pattern. Though not inherently mechanistic, AI models complement traditional methods to elucidate the complexities of environmental systems and design effective solutions. This lecture provides a review of AI applications in water treatment research and development, with a focus on performance prediction, key variables identification, and system optimization for desired water quality output. Furthermore, challenges and future prospects are discussed to underscore the promising role of AI in the field of water treatment.

Nurul Alvia Istiqomah is a lecturer in the Department of Civil and Environmental Engineering, Universitas Gadjah Mada. She earned her Bachelor's degree in Environmental Science and Engineering from Universitas Airlangga in 2016. Subsequently, in 2019, she obtained a Master's degree in Environmental Engineering from National Chiao Tung University. In 2023, she completed her Ph.D. in Civil, Environmental, and Architectural Engineering from Korea University.

Her research revolves around sustainable materials development for water, wastewater, and air remediation. Her recent research areas also include predictive modeling using artificial intelligence approaches in heterogenous catalytic water treatment processes.

Local Organizing Committee

Jong-Sub Lee	jongsub@korea.ac.kr
Tae Sup Yun	taesup@yonsei.ac.kr
Yong-Hoon Byun	yhbyun@knu.ac.kr
Thomas Kang	tkang@snu.ac.kr
Goangseup Zi	g-zi@korea.ac.kr
Young K. Ju	tallsite@korea.ac.kr
Seungjun Kim	rocksmell@korea.ac.kr
Chulsang Yoo	envchul@korea.ac.kr
Seungkwan Hong	skhong21@korea.ac.kr
Hunhee Cho	hhcho@korea.ac.kr
Donghwi Jung	sunnyjung625@korea.ac.kr

Conference Office

+82-2-3290-4728, 4729

fPHI.conference@gmail.com

fphi.korea.ac.kr

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