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5th International Conference on

ACE Forensic Engineering

Architectural, Civil and Environmental

January 13-16, 2026

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

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5th International Conference on

ACE Architectural, Civil and Environmental Forensic Engineering

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Welcome Message

On behalf of the Organizing Committee, it is our great pleasure to invite you to the 5th International Conference on Architectural, Civil and Environmental (ACE) Forensic Engineering, to be held at Korea University, Seoul, Republic of Korea. This conference is organized by the Hyper-converged Forensic Research Center Committee and hosted by the Korean Geotechnical Society (KGS), the Korean Society of Steel Construction (KSSC), and the Korean Water Resources Association (KWRA).

The conference will be conducted online via Zoom from January 13 to 16, 2026, from 8:30 a.m. to 6:00 p.m. (Korea Standard Time, KST). Its objective is to address current issues in forensic engineering related to failures, collapses, and other performance problems of construction facilities and the built environment. The program covers three major infrastructure domains—Geotechnical Engineering, Structural Engineering, and Hydro-Environment—and focuses on enhancing resilience, response, and recovery from large-scale and complex disasters.

A total of 39 distinguished speakers have been invited to deliver presentations across these three major technical themes.

We would like to express our deepest appreciation to all participants and extend our sincere thanks to the distinguished speakers for their invaluable contributions and dedication. We hope that you will find this conference both enriching and rewarding, and we look forward to productive discussions and meaningful exchanges of ideas.

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

Professor, *School of Civil, Environmental & Architectural Engineering, Korea University*
Chair, *5th International Conference on ACE (Architectural, Civil and Environmental) Forensic Engineering*
PI, *Hyper-converged Forensic Research Center for Infrastructure*
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Day 1	Innovation in Geotechnical Engineering	Jan 13, 2026
10:20–10:25	**Welcoming Address** Jong-Sub Lee *(PI, Hyper-converged Forensic Research Center for Infrastructure, South Korea)*	
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10:55–11:20	**Value of Distributed Sensing for Geotechnical Engineering** Kenichi Soga *(Professor, University of California, Berkeley, USA)*	
11:20–11:45	**Promotion of Detailed Subsurface Investigation for Avoidance of Georisk** Ikuo Towhata *(Professor, Kanto Gakuin University, Japan)*	
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14:25–14:50	**A Comparative Study on Applicability of MT-InSAR, PS-InSAR, and SBAS-InSAR Techniques for Geotechnical Structures** Hyungjoon Seo *(Professor, Seoul National University of Science and Technology, South Korea)*	
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Session 3 : Advances in Foundation Engineering		*Chair: Jong-Sub Lee*
15:40–16:05	**Design Safeguards in Micropile Foundations for the New Railway Bridge at Kelaniya, Sri Lanka** K.L.S. Sahabandu *(President, Sri Lankan Geotechnical Society, Sri Lanka)*	
16:05–16:30	**Evaluation of Rainfall-Induced Slope Failure Using Physics-Informed Neural Network (PINN) Approach** Kuo Chieh Chao *(Professor, Asian Institute of Technology, Thailand)*	
16:30–16:55	**Experience of Design and Construction on Loess Subsidence Soils in Conditions of High Seismicity: The Tajikistan Case** Pulod Aminzoda *(Doctor, IGEES, National Academy of Sciences of Tajikistan, Tajikistan)*	

Day 2 | Challenges in Geotechnical Engineering | Jan 14, 2026

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13:35–14:00	**Rectification of a Collapsed Retaining Wall** Chan Swee Huat *(President, Malaysian Geotechnical Society, Malaysia)*
14:00–14:25	**Disaster Dynamics in Nepal: A Geotechnical Perspective on Earthquake-Induced, Rainfall-Induced, and GLOF-Induced Hazards** Indra Prasad Acharya *(Professor, Tribhuvan University, Nepal)*
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Session 5 : Underground Stability Assessment — *Chair: Tae Sup Yun*

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15:40–16:05	**The Experience with the Vibration Monitoring Method for Driving Piles in an Existing Foundation on Pavlodar City of Kazakhstan** Askar Zhussupbekov *(Professor, L.N. Gumilyov Eurasian National University, Kazakhstan)*
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Session 6 : Applied Geotechnical Engineering — *Chair: Hyungjoon Seo*

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17:20–17:45	**Advanced Material Characterization for Transportation Substructure** Yong-Hoon Byun *(Professor, Kyungpook National University, South Korea)*

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08:50–09:00	**Introductory Comments & Welcoming Address**

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09:00–09:25	**Innovation and Challenges in Structural Fire Engineering** Venkatesh Kodur *(Professor, Michigan State University, USA)*
09:25–09:50	**Structural Evaluation of a Historic Wooden Building Using 3D Laser Scanning** Young K. Ju *(Professor, Korea University, South Korea)*
09:50–10:15	**Applications of Artificial Neural Networks for Anomaly Detection in Various Structures** Seungjun Kim *(Professor, Korea University, South Korea)*

Special Session : Investigation and Restoration of Heritage Structures - Part Ⅰ — *Chair: Thomas Kang*

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10:50–11:15	**Masonry Structures and a Heritage Case Study of a Korean Stone Pagoda** Thomas Kang *(Professor, Seoul National University, South Korea)*
11:15–11:40	**Forensic Assessment and Sustainable Restoration of Vernacular Heritage: The Case of Ushaiger Village, Saudi Arabia** Silvia Mazzetto *(Professor, Prince Sultan University, Saudi Arabia)*
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Special Session : Investigation and Restoration of Heritage Structures - Part Ⅱ — *Chair: Mehrdad Hejazi*

13:00–13:25	**Heritage Railway Masonry Viaduct: A Case of Multidisciplinary Approach in Protection** Arkadiusz Kwiecień *(Professor, Cracow University of Technology, Poland)*
13:25–13:50	**Documenting and Studying the First Indigenous Peoples of South Africa's Tangible and Intangible Heritage Applying an Indigenous Methodology** Magda Minguzzi *(Professor, Nelson Mandela University, South Africa)*
13:50–14:15	**Conservation-Oriented 3D and Thermal Imaging Study of the Historic Vault Polychrome in St. Mary's Basilica, Krakow** Izabela Joanna Drygala *(Professor, Cracow University of Technology, Poland)*
14:15–14:30	*Break*

Special Session : Investigation and Restoration of Heritage Structures - Part III *Chair: Thomas Kang*

14:30–14:55	**The Sanctuary by the Western Walls of Paestum: Histories of Collapses and Structural Failures** Luigi Petti *(Professor, University of Salerno, Italy)*
14:55–15:20	**Application of the Artificial Neural Networks on the Structural Health Monitoring for the Offshore Structures** Dominika Kuśnierz-Krupa, Michał Krupa *(Professor, Cracow University of Technology, Poland)*
15:20–15:45	**Structural Restoration of the Wooden Veranda of the World Heritage Building of Ali Qapu in Isfahan** Mehrdad Hejazi *(Professor, University of Isfahan, Iran)*

Day 4 | Innovation and Challenges in Water and Environmental Engineering | Jan 16, 2026

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

Session 1 : Water and Environmental Engineering I — *Chair: Donghwi Jung*

10:00–10:30	**Flood Risk Management Using AI-CCTV** Donghwi Jung, Jinyong Kim, Sohee Kim *(Professor•Research Engineer•Integrated Master-Doctoral Student, Korea University, South Korea)*
10:30–11:00	**Flood Warning in Thailand: Current Situation and Research** Chaiwat Ekkawatpanit *(Professor, King Mongkut's University of Technology Thonburi, Thailand)*
11:00–11:30	**Hydro-Informatics in Indonesia: An Academic Perspective** Hadi Kardhana *(Professor, Institut Teknologi Bandung, Indonesia)*
11:30–12:00	*QNA Session*
12:00–13:30	*Lunch*

Session 2 : Water and Environmental Engineering II — *Chair: Chulsang Yoo*

13:30–14:00	**Forensic Investigation of Incidents in Embankment Dams** DongSoon Park *(Head Researcher, K-water Research Institute, South Korea)*
14:00–14:30	**Forensic Engineering of Urban Flash Floods in Sylhet: Causes, Impacts, and Data-Driven Mitigation** Shabbir Ahmed Osmani *(Professor, Leading University, Bangladesh)*
14:30–15:00	**Climate Change and its Impacts on the Large Reservoir Systems** Subbarao Pichuka *(Professor, Indian Institute of Technology Madras, India)*
15:00–15:30	**Baseflow Separation and Prediction Using Machine Learning** Dagang Wang *(Professor, Sun Yat-sen University, China)*
15:30–16:00	*Break*

Session 3 : Water and Environmental Engineering III — *Chair: Changhyun Jun*

16:00–16:30	**From Pixels to Intelligence: AI-Driven Hydrological Insight for Flood, Drought, and Ecosystem Resilience** Changhyun Jun *(Professor, Korea University, South Korea)*
16:30–17:00	**System Dynamics Modeling for Water/Transportation Carbon Emissions and Energy Consumption** Yan Zheng *(Professor, Nanjing Forestry University, China)*
17:00–17:30	**Innovating Open-Source Hydrological Modeling: Streamflow Simulation and Reservoir Operations in the Nam Mu River Basin, Vietnam** Thi Thuy Ngo *(Senior Researcher, IMHEN, Vietnam)*

Deep Learning-Driven Length Optimization and Capacity Evaluation of Bored Piles Using Sequential Soil Profiles

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This study presents a transformer-based framework for determining optimal embedded length and evaluating axial bearing capacity of prebored and precast piles (i.e., bored piles) using sequential soil profiles. The framework includes two models: a length prediction model that calculates required embedded length given target bearing capacity, and a capacity prediction model that estimates end bearing and skin friction capacities for specified embedded length. Both models were trained with dynamic load test data from construction sites in South Korea. Rather than using averaged soil parameters as in traditional methods, the framework processes full depth profiles of standard penetration test N-values and soil classifications extracted from three-dimensional ground domains, preserving essential stratification information that influences pile resistance. Training results showed reliable predictions under various ground conditions. In practical application, when design bearing capacity was given to the trained length prediction model at each pile location, results indicated that current design practice is generally conservative. Predicted optimal lengths decreased by 1.3 meters on average, achieving approximately 8 % material reduction. The capacity prediction model confirmed these shortened designs maintain sufficient safety margins, eliminating the need for additional field load testing. The framework advances pile design from empirical methods toward data-driven optimization for cost-effective foundation solutions.

Tae Sup Yun is a Professor at the School of Civil and Environmental Engineering at Yonsei University, and served 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.

Value of Distributed Sensing for Geotechnical Engineering

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A framework is proposed to transform geotechnical infrastructure practice "from geo-monitor to geo-adapt" by embedding intelligence in the ground and structures themselves. Emerging distributed sensing technologies—particularly distributed fiber optic sensing, wireless sensor networks, computer vision, UAVs and InSAR—enable spatially and temporally continuous observations of deformation, environmental loading and construction processes. These dense data streams are integrated with data analytics and machine learning to move beyond factor-of-safety snapshots toward performance-based, real-time management of safety, serviceability and resilience. Several case studies will be presented to show that monitoring should be an integral part of design and construction, enabling quality control, adaptive maintenance and potential reuse, and that future infrastructure should be conceived as geo-cyber-physical systems capable of learning and adapting over their service lives.

Kenichi Soga is the Donald H. McLaughlin Chair in Mineral Engineering and a Distinguished Professor of Civil and Environmental Engineering at UC Berkeley. He is also the Director of the Berkeley Center for Smart Infrastructure, a faculty scientist at Lawrence Berkeley National Laboratory, and serves as a Special Advisor to the Dean of the College of Engineering for Resilient and Sustainable Systems. His research focuses on infrastructure sensing, performance-based design and maintenance of infrastructure, energy geotechnics, and geomechanics from micro to macro. He has published more than 500 journal and conference papers and is a co-author of "Fundamentals of Soil Behavior". He is a member of the National Academy of Engineering, a fellow of the UK Royal Academy of Engineering, the Institution of Civil Engineers (ICE), the American Society of Civil Engineers (ASCE), and the Engineering Academy of Japan (EAJ). He is currently one of the three editors-in-chief of "Data-Centric Engineering". He has received several notable awards, including the George Stephenson Medal and Telford Gold Medal from ICE in 2006, the Walter L. Huber Civil Engineering Research Prize from ASCE in 2007, the 63rd Rankine lecture in 2025, and the UCB Bakar Prize for his work on commercializing smart infrastructure technologies in 2022.

Promotion of Detailed Subsurface Investigation for Avoidance of Georisk

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Visiting Professor, Kanto Gakuin University towhata.ikuo.ikuo@gmail.com

Troubles are frequently encountered during construction or after completion of geotechnical structures. Those troubles are exemplified by troublesome soil conditions, high ground water pressure, abandoned underground structures, subsidence or tilting of a structure and others that cause delay in or additional expenditures for continuation of construction works. Being unforeseeable, the troubles caused by those underground problems are called georisk. It is not uncommon that those georisk problems are investigated by a third party and concluded to have been avoidable if reasonable underground investigation had been carried out in advance. The problem herein is that most clients are reluctant to allocate more budget on geotechnical investigations. The author, in conjunction with the Japan Georisk Society, summarized the ten-year interviews by the Georisk Society on how the on-site engineers feel on avoidance or mitigation of georisk. The practitioners' opinion can be summarized that, on average, two percent of the construction budget should be allocated on subsurface investigation, whereas the current practice is only 0.5 % is spent on subsurface investigation. On the other hand, it is important that only qualified consulting firms should be allowed to receive this two-percent fee for their elaborate investigation and that less qualified firms are not allowed to do so. This extra business income is able to introduce more advanced technologies into geotechnical investigation and improve the image of the discipline.

Ikuo Towhata served as a professor of civil engineering at the University of Tokyo from 1994 to 2015. He obtained all the degrees from the same university (Ph. D. in 1982). After the degree program, he worked at several places as a post-doctoral fellow at the University of British Columbia (1982-1983), as an assistant professor at the Asian Institute of Technology (1985-1987) and as an associate professor at the University of Tokyo. His major fields of research have been concerning the earthquake geotechnical engineering (numerical analysis, laboratory tests and field investigation as well as damage reconnaissance), constitutive modelling of sandy soil, and, in the more recent times, landslides triggered by heavy rain. After retirement from the University of Tokyo, he has been working as a visiting professor for the Kanto Gakuin University in Yokohama (2015-present) and a distinguished visiting professor at the Indian Institute of Technology, Bombay, in Mumbai of India. He has been also spending time in private sectors, working as the director of Tohata Architects and Engineers (his family business), as technical advisors for Chuo Kaihatsu Corporation, Tokyo, Giken Ltd., Kochi, Japan, and the Japan Nuclear Sheter Association. As per engineering societies, he was the President of the Japanese Geotechnical Society (2014-2016) and the Vice President for Asia of the International Society for Soil Mechanics and Geotechnical Engineering. His recent international activities are the earthquake damage reconnaissance in Turkey (2023) and Myanmar (2025), delivering keynote lectures for international conferences on cultural heritage, earthquake geotechnical engineering and slope monitoring. He is also interested nowadays in the engineering significance of fault and tectonic actions of the earth. He has delivered many honorable lectures, including the Heritage Lecture during the 16th International Conference on Soil Mechanics and Geotechnical Engineering in Osaka, 2005, and the ISSMGE TC201 Ishihara Lecture in Rome in 2019.

Design and Construction of Linkway with Underpinning and SCL Tunnels with Ground Freezing Crossing Underneath Existing MRT 'Live' Tunnels for Thomson-East Coast Line Marina Bay Station in Singapore

Lew Geok Theng, Michelle
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The Thomson-East Coast Line (TEL) extension at Marina Bay Station intersects a highly constrained urban environment, with the existing North South Line (NSL) and Circle Line (CCL) operating in close proximity. A new Underground Pedestrian Linkway connecting to the existing Marina Bay Station was constructed directly beneath the live NSL tunnels using an Open-Faced Rectangular Shield Machine. This required cutting through existing NSL piles and executing complex underpinning works. Beneath this linkway, two vertically stacked TEL railway tunnels were constructed using the Sprayed Concrete Lining (SCL) method.

The site's challenging geotechnical profile comprises reclaimed sand fill, extremely soft marine clay of the Kallang Formation, and dense sandy silt of the Old Alluvium. To safely tunnel through the marine clay using the shield machine, horizontal jet grouting was adopted beneath the existing tunnels, where vertical installation was not feasible. During shield excavation, NSL piles were removed, and the live tunnels were temporarily jacked up using flat jacks to transfer loads to newly installed beams.

To facilitate safe excavation of the lower TEL tunnel through the OA, a Ground Freezing Method was implemented to control groundwater—marking its first application in a Singapore railway project. A 3D Finite Element Method analysis was conducted to predict and manage tunnel movements induced by shield tunneling, ground freezing, and SCL excavation.

The works were completed safely and successfully through the integrated efforts of the design, construction, and instrumentation & monitoring teams, showcasing innovative solutions in complex urban tunneling.

Michelle is the Director of Kiso-Jiban Singapore Pte Ltd, a Professional Engineer (Civil), Specialist Professional Engineer (Geotechnical) and Specialist Accredited Checker (Geotechnical) registered in Singapore. With over 23 years of experience in geotechnical and underground infrastructure projects, she has been instrumental in advancing engineering practices in deep excavation, tunnelling, and soil-structure interaction analysis.

A graduate of Nanyang Technological University (B.Eng. Civil, 2002), Michelle began her career during Singapore's major underground infrastructure boom and has since contributed to numerous landmark projects, including the Thomson Line T226 Marina Bay Station, where she pioneered the use of ground freezing technology—a first for a metro project in Singapore. Her technical leadership has also been integral to complex developments such as the Cross Island Line, Downtown Line, and Tuas Terminal Phase 2.

Michelle's dedication and expertise have earned her multiple professional accolades and team awards.

Beyond her project work, Michelle is deeply involved in the professional community. She currently serves as President of the Geotechnical Society of Singapore (GeoSS) and is an active mentor and educator, sharing her expertise as a part-time tutor at the National University of Singapore from 2018 to 2023.

Recognised as one of Singapore's few female geotechnical specialists, she continues to advocate for women in engineering, encouraging the next generation to pursue technical excellence and resilience in this demanding field. Her career focus remains on geotechnical infrastructure, deep excavations, and underground MRT developments, contributing to Singapore's safe and sustainable urban growth.

A Comparative Study on Applicability of MT-InSAR, PS-InSAR, and SBAS-InSAR Techniques for Geotechnical Structures

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Recent advances in Interferometric Synthetic Aperture Radar (InSAR) technology have enabled high-precision monitoring of subtle ground deformation over large areas. This study aims to evaluate and compare the applicability and limitations of three representative InSAR techniques—MT-InSAR (Multi-Temporal InSAR), PS-InSAR (Persistent Scatterer InSAR), and SBAS-InSAR (Small Baseline Subset InSAR)—for monitoring geotechnical structures. Various deformation cases, including road and railway subsidence, sinkholes, ground collapse, consolidation settlement, airport runway subsidence, landslides, and Antarctic ice-sheet subsidence, were analyzed. Each method was assessed in terms of spatial and temporal resolution, data requirements, noise characteristics, and model accuracy. The results indicate that PS-InSAR provides high accuracy in urban infrastructure monitoring such as roads and railways; SBAS-InSAR is well-suited for large-scale consolidation and landslide monitoring; and MT-InSAR offers robust displacement estimation in complex observation environments such as airports and polar regions. This study suggests an optimal InSAR technique for each geotechnical condition and is expected to contribute to the development of satellite-based infrastructure safety management and ground deformation prediction systems.

Hyungjoon Seo is an Associate Professor at the Department of Civil Engineering at Seoul National University of Science and Technology. After completing his Ph.D. at Korea University, he researched SMART monitoring as a researcher at the University of Cambridge, UK, for three years from 2013. From 2016 to 2020, he was an assistant professor at Xi'an Jiaotong Liverpool University in China, and then from 2020 to 2024, he was an assistant professor at the University of Liverpool in UK. His research area is the study of SMART monitoring such as fiber optic sensing, wireless sensing, and remote sensing such as satellite monitoring (InSAR), drone monitoring, LiDAR (laser scanning) in geotechnical structures, combined with AI-based analysis techniques such as deep learning and machine learning. He has published over 50 SCIE papers on these topics, and has presented two keynote lectures and three invited lectures at academic conferences. He is currently serving as the international director of the Korean Tunnelling and Underground Space Society, and is also working as an editor of six international journals.

Advancing Geothermal Development in Metamorphic Rock Reservoirs through Anisotropic THM Modeling

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Geothermal energy has emerged as a reliable and sustainable renewable resource, particularly suited for tectonically active regions. Taiwan, located at the convergence of the Eurasian and Philippine Sea plates, possesses significant geothermal potential hosted mainly in slate, a metamorphic rock exhibiting strong anisotropy and heterogeneity. These characteristics greatly affect fracture propagation and fluid flow, posing challenges for efficient energy extraction. This study develops an anisotropic thermal–hydro–mechanical (THM) modeling framework to evaluate the performance of slate geothermal reservoirs. An anisotropic thermal–mechanical failure criterion, derived from high-temperature triaxial tests, was implemented in a discrete element model to simulate coupled fracture and thermal processes during hydraulic stimulation. Benchmark and field-scale simulations validate the model's capability to capture foliation-controlled failure and heat transfer. Results indicate that well orientation significantly influences thermal efficiency, with horizontal wells perpendicular to major joints yielding optimal heat extraction and minimal structural disturbance. The findings highlight the critical role of anisotropy in reservoir behavior and provide guidance for sustainable geothermal development in metamorphic formations.

Meng-Chia Weng is a full professor in the Department of Civil Engineering at National Yang Ming Chiao Tung University, Taiwan. He holds his Bachelor's and Ph.D. degrees in Civil Engineering from National Taiwan University in 1997 and 2002, respectively. Dr. Weng's research primarily focuses on rock mechanics, landslides, thermal-hydraulic-mechanical coupling analysis, constitutive modeling of geomaterials, and the application of discrete and finite element methods. He is a licensed civil, geotechnical, and structural engineer in Taiwan. He worked at the Geotechnical Center of Sinotech Engineering Consultants, Inc. from 2004 to 2006 and later served on the faculty of the National University of Kaohsiung until 2017. He was a visiting scholar at Columbia University in 2011 and joined National Chiao Tung University in 2017. He has published more than 100 journal papers and has been recognized with numerous awards, including the Excellent Paper Award at the Taiwan Geotechnical Engineering Conference, the Outstanding Paper Award at the Taiwan Rock Mechanics Symposium, the GeoChina 2021 Best Paper Award, and both the ISRM Conference Scholarship and Outstanding Poster Award. Dr. Weng currently serves as President of the Chinese Taipei Geotechnical Society (CTGS) and Vice President of the Society of Rock Mechanics and Engineering Geology, Taipei. He also holds several editorial positions, including Associate Editor for the Journal of Materials in Civil Engineering (ASCE), Editor for the Journal of GeoEngineering, Guest Editor for Engineering Geology, and Chief Editor for Sino-Geotechnics.

Design Safeguards in Micropile Foundations for the New Railway Bridge at Kelaniya, Sri Lanka

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The new double-line railway bridge at Kelaniya was constructed immediately adjacent to a century-old colonial-era bridge founded on caissons. The close proximity of the two structures required a forensic and highly cautious approach to assess, preserve, and safeguard the integrity of the existing foundation system during the new construction. Detailed subsurface investigations identified thick alluvial deposits comprising soft and loose soils, including organic layers, underlain by weathered rock. After evaluating multiple foundation alternatives, micropiles were selected owing to their adaptability, low-vibration installation, and minimal risk to adjacent heritage structures.

This lecture presents the forensic evaluation of the subsurface conditions, the rationale for selecting the micropile foundation system, and the design considerations arising from the interaction between structural and geotechnical parameters. Special emphasis was placed on potential failure mechanisms, including micropile buckling through weak organic strata and possible disturbances to the old caisson foundations. Field verification through static load testing validated theoretical predictions and revealed that structural capacity, rather than geotechnical capacity, governed the overall performance—contrary to conventional expectations. The study highlights the critical role of innovative design thinking and predictive modeling in developing safe, durable, and context-sensitive foundation solutions for new structures constructed adjacent to historic infrastructure.

K.L.S. Sahabandu is a distinguished engineer with over 40 years of experience in the engineering consultancy sector. He has served leading organizations in Sri Lanka, most notably the Central Engineering Consultancy Bureau (CECB), the country's largest multidisciplinary consultancy firm, where he retired as General Manager in 2019. He currently serves as Head of the Engineering Consultancy Division at the Urban Development Authority (UDA).

His expertise spans structural and geotechnical design for major national projects in hydropower, water resources, high-rise / multi story buildings, highways, railways, harbours, and airports. He played a key role as Team Leader, Designer, Technical Committee Member, and Investigator etc. in both structural and geotechnical / foundation disciplines.

Eng. Sahabandu presently serves as President of both the Sri Lankan Geotechnical Society (SLGS) and the Association of Consulting Engineers – Sri Lanka (ACESL). He is also a former President of the Society of Structural Engineers, Sri Lanka (SSESL) and Immediate Past Vice President of the Sri Lanka National Committee of large Dams (SLNCOLD).

He has been recognized with several national honours, including the Construction Industry Development Authority (CIDA) Award of Eminence (2016) and the Chartered Engineer Excellence Award (2018), and the Eng. (Dr.) A. C. Visvalingam Award for the Most Outstanding Engineer (2023) from the Institution of Engineers, Sri Lanka (IESL), acknowledging his exceptional contribution to the engineering profession and the construction industry in Sri Lanka.

Evaluation of Rainfall-Induced Slope Failure Using Physics-Informed Neural Network (PINN) Approach

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Rainfall-induced slope failure is one of the most challenging natural hazards that commonly occurs after intense rainfall events in mountainous areas. From a geotechnical perspective, failure could occur when heavy rainfall increases infiltration, reduces soil suction in unsaturated soils, and consequently lowers slope stability. Therefore, if rainfall-driven changes in soil water content can be predicted, slope stability can be assessed. This study develops and evaluates a physics-informed neural network (PINN) that embeds Richards' equation and assimilates observations to predict soil moisture profiles in unsaturated slopes during rainfall. Laboratory experiments used a physical slope model filled with red clayey sand and white sandy clay, subjected to controlled rainfall intensities (10, 50, and 90 mm/h) and slope angles (0°, 15°, 30°). Soil properties, including SWCCs, were determined experimentally, and finite-element method (FEM) simulations were calibrated to the observations. The PINN was first trained using observations only, then extended to a hybrid scheme that combined FEM outputs with observations. It was concluded that the hybrid PINN approach improved accuracy, resolving infiltration dynamics and wetting-front propagation more effectively, with closer agreement with both observations and FEM results. These findings suggest that dense sensor networks and richer observational data could further enhance PINN performance and support real-time landslide hazard assessment. Overall, the study shows that PINNs can reasonably predict soil water content and thereby enable stability evaluation for various rainfall events.

Geoff Chao, Ph.D., P.E. has over 30 years of geotechnical and construction engineering experience. He received his Master and Ph.D. degrees from Colorado State University, Fort Collins, Colorado, USA in 1995 and 2007, respectively. He is an Associate Professor at the Asian Institute of Technology (AIT) in Bangkok, Thailand. He is also currently the President of the Southeast Geotechnical Society. Before joining AIT, he was the Vice President of Engineering Analytics, Inc., a geotechnical and environmental engineering consulting company in Fort Collins, Colorado, USA. Dr. Chao has extensive experience in the areas of geotechnical and reclamation engineering design, construction, and design defect investigations, ground improvement, construction remediation and mitigation, and construction oversight experience on a diversity of projects. His technical specialties include expansive and collapsible soils evaluation, unsaturated soil modeling, soil/ground improvement methods, landslide/debris flow investigation, soil-foundation interaction, soil behavior under dynamic loadings, and mining reclamation. Dr. Chao was an Adjunct Professor at Colorado State University. He is the co-author of a textbook titled “Foundation Engineering for Expansive Soils”. Dr. Chao has authored over 100 technical papers, many of them dealing with structures on problematic soils.

Experience of Design and Construction on Loess Subsidence Soils in Conditions of High Seismicity: The Tajikistan Case

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The territory of Tajikistan is located in a high seismic zone. Due to this, to ensure the seismic resistance of buildings and structures under the design seismic impact, the implementation of special measures is envisaged during design and construction in the country. At the same time, the foundations of most buildings and structures erected in Tajikistan are based on loess subsidence soils. Construction on loess subsidence soils, in turn, should also include the implementation of special measures to protect against the subsidence of foundation soils. Failure to implement such measures may lead to severe damage to buildings long before the occurrence of a strong earthquake.

In Tajikistan, different methods are used to strengthen the subsidence soils underlying the foundations of buildings and structures. First of all, arrangement of a soil cushion by excavating a layer of soil and laying compacted soil instead. Over the past years, soil cushions have been implemented using a mixture of local loamy and gravel soils. In the case the thickness of subsidence soils is small (up to 20-25 m), a highly effective method to exclude the influence of subsidence soils on the building condition is to install a pile field from borehole piles resting on gravel soils and being firmer than loess soils.

Pulod Aminzoda is a leading expert in earthquake engineering field in Tajikistan and currently is working as a leading researcher at the Institute of Geology, Earthquake Engineering and Seismology of the National Academy of Sciences of Tajikistan (IGEES). Until the middle of March 2025, he was the head of this Institute. Pulod Aminzoda received his Master of Sciences in Civil Engineering in Tajik Polytechnical Institute, Industry and Civil Engineering Department in Dushanbe, Tajikistan in 1982. In 1982-1984 he worked as a research engineer in Department of Seismic Stability of Buildings and Structures of IGEES. In 1984-1987, he graduated the post-graduate school of Central Research Institute for Building Constructions of the USSR State Committee for Construction (TsNIISK), Moscow, Russia and in 1988 defended his Ph.D. thesis in earthquake engineering field. In 1987, Aminzoda P. came back to IGEES, where worked in positions ranging from scientific researcher to the Director of IGEES and currently is the leading researcher of the Institute.

His research interests are the theoretical and practical aspects of seismic stability of buildings and structures, including the dams, processing of strong motion data recorded by Institute's strong motion monitoring systems, seismic vulnerability and seismic risk assessment, rehabilitation and retrofitting of damaged under seismic excitations and soils subsidence structures, providing the expertise of the designs of structures for construction and reconstruction in Tajikistan, development of seismic and other building codes of Tajikistan. Aminzoda P. is the expert of the CIS's countries Base Organization on earthquake engineering, member of the Regional Scientific and Technical Council of the Regional Center for Emergency Situations and Disaster Risk Reduction, located in Almaty, Kazakhstan, International Consultant of UNDP, Turkmenistan is seismic vulnerability reduction. He delivered many keynote lectures in international and conferences including the Asian Conference on Disaster Reduction 2023, Central Asian Geoscience Forum 2024, Regional Forum "Strengthening Financial Resilience and Accelerating Risk Reduction (SFRARR) in Central Asia". He is the author and editor of Tajikistan's seismic coded, a large number of scientific and scientific-technical reports, published more than 10 journal papers and 20 conference papers.

Improvement of Elastic-Plastic Models for Predicting Soil Shear Deformations and Strength

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This presentation provides a review of soil deformation models that describe its nonlinear mechanical properties under compression and shear. Such models are widely used in numerical analyses of deformability, strength, and stability, as well as in various computational software packages. It is known that both linear and nonlinear elastoplastic models with the Mohr–Coulomb strength criterion, Cam-Clay models, double hardening models, and others are widely used today. The applicability of these models for describing the yield surface and the elastoplastic properties of soil is analyzed. The article presents an elastoplastic model proposed by the authors, which characterizes the nonlinear deformation behavior of soil. This model assumes a separate description of the total compression and shear deformations and differs from existing models in that it is based on generalized deformations, whereas the elastic components are considered separately and are added to or subtracted from the total deformations. Traditional soil strength parameters are used as the yield criteria.

Askar Khasanov is the President of the Geotechnical Society of Uzbekistan and a Professor and Head of the Department of Theoretical and Engineering Mechanics at Samarkand State University. He received his bachelor's degree in Civil Engineering from the Samarkand State Architectural and Construction University in 1974. He earned his Ph.D. in Technical Sciences in 1982 from the Moscow State University of Civil Engineering (MGSU) and his Doctor of Technical Sciences (D.Sc.) degree in 2001 in Samarkand. After completing his Ph.D., he worked at SamGACU from 1976 to 2022 as a professor, while also serving as the director of the geotechnical company «GeoFundamentProject» LLC. He delivered numerous plenary and keynote lectures at international conferences in Potsdam (Germany), Singapore, Kolkata (India), Hong Kong, Fukuoka (Japan), Incheon and Seoul (Korea), Saint Petersburg and Voronezh (Russia), Minsk (Belarus), and Astana (Kazakhstan), focusing on soil mechanics and geotechnical engineering. He has published more than 150 scientific papers, including 125 in international journals and conference proceedings and 25 in national journals, as well as 12 patents in Russia and Uzbekistan. His research interests include foundations on collapsible soils, restoration of architectural monuments, soil strength and stability, soil investigation methods, and foundation engineering. He is a laureate of several major professional awards, including the N. M. Gersevanov Medal (the highest award of the Geotechnical Society of Russia), the Academician T. Zh. Zhunisov Medal (the highest award of the Geotechnical Society of Kazakhstan), and the highest medal of the Siberian Geotechnical Society

Rectification of a Collapsed Retaining Wall

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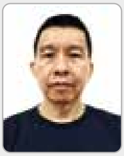
The rectification works addressed the failure of a permanent anchored steel sheet pile wall with concrete facing along a riverbank. Behind the collapsed wall is the paved backlane of an existing factory, which serves as a car parking and goods loading/unloading area. The collapse led to significant settlement, cracking, and instability of the backlane pavement. Several rectification alternatives were considered, including a reinforced concrete (RC) wall, a contiguous bored pile (CBP) wall, and deep soil mixing (DSM) columns. DSM was ultimately selected for its constructability, time efficiency, and cost-effectiveness. The DSM system comprised 570 columns of 1.0 m diameter, installed in a triangular grid with 0.866 m spacing. The columns were terminated at 10.0 m depth or at the top of rock, whichever occurred first. The design specified a target unconfined compressive strength (UCS) of 1.0 MPa. This presentation will highlight the design and construction aspects of the DSM works, including laboratory and field trial mixes, sampling procedures, and UCS test results.



Chan Swee Huat is a registered Professional Engineer with Practising Certificate under the Board of Engineers Malaysia since 2005. He graduated with First Class Honours in Civil and Structural Engineering from Universiti Kebangsaan Malaysia in 1997 and obtained his Ph.D. from the National University of Singapore in 2003. He began his career as a Geotechnical Engineer with SSP Geotechnics Sdn. Bhd., later serving as a Resident Engineer with Dr. C.T. Toh Consultant. He is a co-founder and Director of Geo-Excel Consultants Sdn. Bhd., a specialist geotechnical consulting firm. With 27 years of professional experience, he has been actively involved in the analysis, design, and construction of a broad spectrum of geotechnical works, including shallow and deep foundations, deep excavations and retaining structures, slope stability and stabilization, seepage analyses, soil improvement techniques, geotechnical failure investigations, and 3-D finite element analyses. He has also served as an independent geotechnical checker and acted as an expert witness in litigation and arbitration cases in Malaysia. In addition to professional practice, he contributes actively to the engineering community. He is currently the President of the Malaysian Geotechnical Society (MGS), Advisor (Immediate Past Chairman) of the Geotechnical Engineering Technical Division (GETD) of The Institution of Engineers, Malaysia (IEM), a Council Member of IEM, and an Honorary Professor at the Department of Civil Engineering, University of Nottingham.

Disaster Dynamics in Nepal: A Geotechnical Perspective on Earthquake-Induced, Rainfall-Induced, and GLOF-Induced Hazards

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Nepal's fragile geology, steep topography and active tectonics setting make it highly susceptible to a range of geotechnical disasters. Earthquake-induced landslides, rainfall-triggered slope failures and Glacial Lake Outburst Floods (GLOFs) pose significant threats to lives, infrastructure and long term developments. This study presents a forensic geotechnical analysis of disaster dynamics in Nepal, emphasizing the mechanisms, triggers and cascading effects associated with major hazard types. Earthquake induced disasters such as those observed during the 2015 Gorkha earthquakes, reveal widespread co-seismic landslides, liquefaction in unconsolidated sediments and long term slope destabilization along weak geological formations. Rainfall-induced failures particularly during extreme monsoon events, demonstrate complex interactions between pore water pressures build up, lithological weakness and slope geometry resulting in shallow landslides, debris flows and riverbank erosion. GLOF-induced disasters further highlight the vulnerability of downstream regions, where rapid flood surges trigger channel widening scour and slope collapses. The findings underscore the growing influence of climate change in amplifying hazard frequency and intensity, particularly through increased rainfall extremes and accelerated glacial melt. By synthesizing multi-hazard forensic evidence, the study offers insights into failure thresholds, spatial patterns of vulnerability and emerging risk pathways. The research ultimately contributes to improved hazard assessment engineering design and disaster mitigation strategies tailored to Nepal's high risk Himalayan terrain.

Indra Prasad Acharya is an Associate Professor of Civil Engineering at Institute of Engineering, Tribhuvan University, Nepal. From 2021 to 2025, Dr. Acharya served as the campus chief of Pulchowk Campus of Institute of Engineering. Under his leadership in 2023, Pulchowk campus received best constituent campus among all Tribhuvan University by Government of Nepal. In recognition of his outstanding contributions to education, honored with the national education prize in 2024 by Ministry of Education, Science and Tecchnology, Government of Nepal. A collaaborative research paper with Dr. Mandip subedi received the best paper award-2022 from the journal of Geoenvironmental Disasters (Springer Publicatins) for the study titled "Liquifaction hazard assessment and ground failure probability analysis in Kathmandu valley of Nepal". He is an active member of the International Society for Soil Mechanics and Geotechnical Engineering (IISMGE) and has over 25 years of academic and professional experience in the field of Geotechnical Engineering. He completed his Bachelor in Civil Engineering from Tribhuvan University, Institute of Engineering, Pulchowk Campus and completed his M.Tech in Civil Engineering specialization in Geotechnical Engineering from Indian Institute of Technology, Kanpur (IITK), India and finished his Ph.D. degree in Civil Engineering specialization in Geotechnical Engineering from Indian Institute of Science (IISc), Bangalore, India. He published many research papers related to Geotechnical Engineering in national and international journals. He is currently serving as the President of the Nepal Geotechnical Society for the 2025-2027 term.

Soil Arching Developed in Foundations of Unconnected Piles

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Soil arching mobilizes when differential stiffness, differential settlement, or a complete loss of support causes a relative displacement within the fill material. The dynamic forces developed at the pile head connection in a traditional piled raft system can cause significant shear stresses and bending moments, especially in seismically active regions. Using the cushion layer in unconnected piled raft foundation system (UPRS) subjected to seismic load may mobilize the soil arching phenomenon. For this concern, the propagation and degradation of soil arching generated in the cushion layer of sand materials joining the raft and piles will be investigated in detail by conducting several experimental tests using shaking table. The settlement of the raft without reinforcement in the cushion layer increased with increasing the thickness of the cushion layer and the spacing between piles, whereas in the reinforced cushion layer, the settlement will decrease as the strength cushion layer increased. The distribution of vertical pressure on and between the piles, at a vertical and horizontal direction it's very clear that the stress on the pile head (supporting zone) increased from the initial value under seismic load, while the stresses between the piles (yielding zone) decreased relatively from the initial value in the dry state but significantly in the saturated state. The lateral displacement decreased with increasing the thickness of the cushion layers regardless with or without reinforcement. The reinforcement of the cushion layer showed better mitigation of horizontal displacement.

Mahdi Karkush is a Professor of Civil Engineering at the Department of Civil Engineering, University of Baghdad, and has served as the President of the Iraqi Scientific Geotechnical Society (ISGS) since 2018. He earned his B.Sc. in Civil Engineering from the University of Babylon in 1995 (ranking 3rd), his M.Sc. in Civil Structural Engineering in 1998, and his Ph.D. in Civil Geotechnical Engineering from the University of Baghdad in 2008. Prof. Karkush began his academic career at the University of Babylon (1999–2008) before joining the University of Baghdad, where he continues his teaching, research, and professional activities. Over the course of his career, he has authored more than 150 scientific publications, including 110 peer-reviewed journal papers and approximately 40 conference contributions, and has supervised over 30 Ph.D. and M.Sc. students. He teaches at the undergraduate, master's, and doctoral levels, and serves on the editorial boards of several international journals. He is also the founder and Editor-in-Chief of the Journal of Geotechnical Engineering and Infrastructures, published by the Iraqi Scientific Geotechnical Society. His professional contributions extend beyond academia, with involvement in hundreds of engineering projects across Iraq, including soil investigations, topographic surveys, GIS applications, structural design, urban planning, and construction. He has also edited more than 10 scientific books with international publishers. His primary research interests include geoenvironmental engineering, sustainable geotechnical engineering, foundation engineering, and geomechanics. Prof. Karkush is a visiting professor at the Eurasian National University in Kazakhstan and holds fellowships with the Iraqi Engineers Association (IEA), the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE), and several international scholarship programs, including Fulbright (USA), DAAD (Germany), and Swinburne University of Technology (Australia). He has been invited as a keynote speaker and presenter at numerous international conferences across Iraq, Russia, Kazakhstan, India, South Korea, Iran, China, Jordan, Turkey, Australia, and Italy.

Feasibility Study of Deep Tunnel Construction Work in the CITY O CIEL

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The population of Incheon Metropolitan City is getting increased every year and now the 3rd largest city after Seoul and Busan in South Korea with the population of 3.021 million people. The high-tech industrial technology such as bio-medical Industry and semi-conductor industries are investing huge amount of capital in Incheon Industrial complex. The logistics hub via Incheon International Airport and Incheon harbors (6 EA) is very actively commercialized. The development of environmental friend residential area is prerequisite to cope with the demand of the Incheon Metropolitan City. In this paper, the feasibility study for conversion highway from bridge decked highway to deep underground tunnel is described in the one of land development projects called “CITY O CIEL”. The slope of underground tunnel is greatly influenced on the speed of car. After investigation of traffic flow and conjunction, speed of car driving, the slope of tunnel is approximately 3 % to maintain its driving speed of 70 km/hr. The total cost of this project is about 78 million USD and the benefit of this deep tunnel construction project is 9 million USD. As the result of B/C is about 0.12 and normally B/C ratio must be higher than 1.0. The proposed deep tunnel construction project is very poor to proceed and another alternative method to solve noise problem is suggested. Finally, Sound Barrier Tunnel method (SBTM) over the elevated bridge highway has been proposed to reduce the noise of traffic operation around residential area.

E.C. Shin is an Immediate Past Vice President of ISSMGE for Asia (2017-2022). Now, he is a Prof. Emeritus at The Incheon National University. He graduated from Chungbuk NationalUniversity 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 Eengineering at the Incheon National University, Korea, where he obtained a full professorship in 2005 and has served as dean of the Urban Science College 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. In the past 30years, 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 received 1st ISSMGE Asian Life Time Service Award (2025) and Gersevanov medel from Russian Geotechnical Society in 2021 and awarded Honorary Doctorates Degree from st. Petersburg Slate University of Architecture and Civil Engineering in 2021.

The Experience with the Vibration Monitoring Method for Driving Piles in an Existing Foundation on Pavlodar City of Kazakhstan

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This lecture presents of the results of vibration monitoring, the purpose of which was to determine the vibration parameters of an existing industrial building from piles driving. Ground vibrations induced by pile driving are transmitted through the subsurface via elastic wave propagation mechanisms and may remain perceptible at significant offsets, frequency exceeding a few hundred meters from the source. The main evalution parameters of vibration are vibration displacement (amplitude), vibration speed, frequency and vibration acceleration. Vibration parameters were measured at different distances from the excitation source: near the pile, at a distance of 10, 50, 100 m. According to the results of the measurements, the dependence of the vibration parameter changes depending on the distance from the excitation source was determined. The work also presents statistical data of the obtained results, on the basis of which an analysis of the relationship of the received individual values of the vibration indicators was carried out. The testing activity was in construction site of Factory of Producing of Gold in Pavlodar city of Kazakhstan. In construction site was performed of geomonitoring of driving piles on problematical soil ground as well.

Askar Zhussupbekov is a Professor of Department of Civil Engineering of Eurasian National University (ENU, Kazakhstan) and also adjunct professor 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 (2012-2025), 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 and as well as consulting work for civil and geotechnical projects at new capital Astana (Kazakhstan), West Kazakhstan (Caspian Sea area), Almaty (old capital of Kazakhstan), Saint-Petersburg, Moscow, Yuzhno-Sakhalinsk (Russia). He delivered many 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, geoinformation data base, in situ testing, preservation of historical sites. He has published more than 400 scientific papers, including 6 books on Geotechnical Engineering. He has been supervised more than 45 Dr. Ph. dissertations and 10 Dr. Engineering dissertations (included foreign students from Japan, Turkey, South Korea, Cambodia, Tanzania, Tajikistan, China, Mongolia, Russia).He is member of ASCE, SEAGS, RGS. GGS.. Prof.Askar was as Chairman of 17ARC on Geotechnical Engineering, 2023.

On the Sink Hole Hazard due to Climate Change

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In recent years, due to the climate change, incidents of 'road collapse' (commonly known as sinkholes) caused by urban underground excavation or aging and damaged pipelines have occurred increasingly in Taiwan area. These incidents have been widely reported by the media, raising public safety concerns and directly affecting our confidence in construction quality. This study not only collects relevant domestic and international cases to understand the causes and mechanisms of road subsidence and collapse, and to identify and classify high-potential areas for such collapses, but also assesses existing techniques for detecting and inspecting pipelines and road quality. The related findings can serve as a basis for establishing construction and maintenance guidelines, revising construction specifications, recommending regular inspection and monitoring of roads and pipelines in the areas with high-risk collapse potential, and suggesting surveys and impact assessments before and after nearby construction. The goal is to reduce the risk of damage to neighboring properties and roads in the future and to maintain the quality of the road as well as the underground infrastructures.

Keh-Jian (Albert) Shou is now VP Asia of International Society for Soil Mechanics and Geotechnical Engineering (2022~2026), Chairman of ISTT (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, Seatlle, 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).

Systematic and Emerging Approaches to Forensic Geotechnical Engineering

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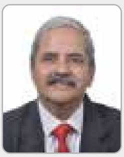
Forensic geotechnical engineering involves scientific, legalistic investigations and deductions to detect the causes as well as the process of distress in a structure, which are attributed to geotechnical origin. Such a critical analysis will provide answers to “what went wrong, when, where, why, how, and by whom”. Cases of remedied installations, particularly those which, fall under public or government category, where the analysis and evaluation of adopted remedial measures with regard to their effectiveness and economy may be subjected to judicial scrutiny also, fall under this purview. It also gives strong inputs to improve designs. The normally adopted standard procedures of testing, analysis, design and construction are not adequate for the forensic analysis in majority of cases. The forensic investigations involve fresh field and laboratory tests apart from collection of all available data. The test parameters and design assumptions will have to be representative of the actual conditions encountered at site. While the designs are mostly stress based, the forensic analysis has to be deformation based. The presentation gives an overview of the steps involved in forensic geotechnical engineering and illustrates the approach with a few case studies. The presentation also highlights the importance of learning from failures in geotechnical engineering which should form an important component in the advancement of geotechnical engineering and presents the case for a post graduate level course in Forensic Geotechnical Engineering.



G L Sivakumar Babu completed Ph.D. (Geotechnical Engineering) in 1991 from Indian Institute of Science, Bangalore, India. He worked as Humboldt Fellow in Germany during June 1999- July 2000 and as visiting Scholar, Purdue University, Lafayette, USA during 2/95 - 2/96. He served as the President of Indian Geotechnical Society during 2017-2020, and as the Chairman of International Technical Committee (TC-302) on Forensic Geotechnical Engineering (FGE) of International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE) from 2014-2022. He is a Fellow of ASCE and also served as Governor, ASCE, Region 10 during 2014-2020. He is also a Fellow of National Academy of Engineering (FNAE) India.

He guided 31 (26 PhDs and 5 MS) research degrees and contributed significantly for teaching and practice. He wrote a book on soil reinforcement and geosynthetics, edited eight books and proceedings and has several publications (International and national Journals -200, International and national conf. more than 200 Total over 400). He received several awards such as John Booker award from IACMAG, Humboldt fellowship from Germany, DST Boyscast Fellowship, and a few awards for the best papers from Indian Geotechnical Society and American Society of Civil Engineers.

Advanced Material Characterization for Transportation Substructure

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Unbound aggregate layer and subgrade, which form the foundation of road infrastructure, are critical to pavement durability and serviceability; consequently, evaluations of resilient modulus and permanent deformation are commonly conducted. Geogrids are also used to stabilize unbound aggregate layers and improve the performance of pavement substructures. This lecture explores advanced methods for characterizing and enhancing transportation substructures. First, the optimization of bender elements as embedded shear wave transducers is introduced to measure wave propagation within large-sized aggregate specimens under repeated triaxial loading. The use of multiple transducers provides a novel way to assess local stiffness variations, revealing the distribution and enhancement of stiffness in geogrid-stabilized aggregates. Furthermore, the lecture covers field applications of modular shear wave transducers, which have been effectively used to monitor stiffness changes in unbound aggregate layers. These transducers have been successfully applied to several transportation infrastructures, such as airport pavements and railway substructures. The development of an In-situ Modulus Detector, which allows for direct and efficient measurement of resilient modulus profiles across various subgrade depths, will also be discussed. Addressing the issue of permanent deformations in unbound aggregate layers caused by repeated wheel loading—a primary contributor to pavement rutting—the lecture reviews the evolution of models for predicting permanent deformation. Empirical models, proposed by the UIUC research group, account for factors such as gradation, load cycles, and stress conditions, with modeling strategies evolving from regression analysis to advanced plasticity theories and machine learning.

Yong-Hoon Byun is a Professor in the Department of Agricultural Civil Engineering at Kyungpook National University. He earned his bachelor's degree (2009) and his Ph.D. (2014) in Civil and Environmental Engineering from Korea University. After working at Korea University for a year, he joined the Transportation Geotechnics research group at the University of Illinois as a Postdoctoral Research Associate in 2015. In 2017, he was appointed 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 techniques. He serves as the Associate Editor of the International Journal of Geo-Engineering and is on the Editorial Board of the Journal of Korean Society of Agricultural Engineers. Recently, he has also served as a Guest Editor for the special issues of Engineering Failure Analysis, Computers and Concrete, and Steel and Composite Structures. He has received several honors, including the Best Paper Award (2016) from the Korean Geo-environmental Society, the Young Researcher Award (2018), the President's Award (2024), and the IJGE Award (2025) from the Korean Geotechnical Society, the Young Researcher Award (2021) from the Korean Society of Agricultural Engineers, and the Outstanding Research Professor Awards (2022–2025) from Kyungpook National University. His research interests include eco-friendly binders and geosynthetics for embankment stabilization, as well as advanced monitoring systems for transportation substructures and earth dams.

Innovation and Challenges in Structural Fire Engineering

Venkatesh Kodur
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Significant advancements in structural engineering over recent decades—enabled by high-performance materials (HPM), innovative architectural concepts, risk-based design approaches, and improved hazard characterization—have enhanced the resiliency, sustainability, and durability of modern infrastructure. However, progress in addressing fire hazards within the built environment has lagged behind these gains.

Fire remains one of the most severe hazards affecting buildings and infrastructure, making the provision of adequate fire safety and structural fire resistance a critical design requirement. Presently, fire resistance is predominantly evaluated through standard fire tests and prescriptive design methodologies. These approaches have well-recognized limitations and often fail to deliver realistic assessments of structural performance under actual fire conditions. Moreover, the increasing use of HPM (e.g., high-strength concrete, high-strength steel, engineered wood, and FRP composites), efficient structural systems (e.g., hollow-core slabs, slender I- and T-sections), open architectural layouts, and advanced nonlinear analysis techniques has resulted in slender lightweight structural configurations. Although these solutions often provide superior performance under ambient conditions, their fire resilience can be significantly lower than that of conventional systems.

To address these challenges, performance-based fire engineering approaches are gaining momentum through the growing discipline of Structural Fire Engineering (SFE), which applies engineering principles to ensure insulation, stability and load-bearing capacity during fire exposure. These methodologies enable more accurate and realistic prediction of structural fire response and help close critical knowledge gaps associated with currently applied prescriptive fire designs.

This presentation will: (i) quantify the magnitude of fire risk in buildings and built infrastructure, (ii) highlight emerging construction trends that increase fire vulnerability, (iii) review limitations of current fire resistance assessment practices, and (iv) discuss recent advances and innovations in SFE, including advanced computational modeling and AI/ML-based techniques. Key research needs and challenges to advancing the state-of-the-art in structural fire engineering will also be outlined.

Venkatesh Kodur is a University Distinguished Professor and Director of the Centre on Structural Fire Engineering and Diagnostics at Michigan State University. He is an internationally recognized scholar for his contributions in civil and fire engineering fields and his research accomplishments have had major impacts. He has developed fundamental understanding on the behavior of materials and structural systems under extreme fire conditions. The techniques and methodologies resulting from his research is instrumental for minimizing the destructive impact of fire in the built infrastructure, which continues to cause thousands of deaths and billions of dollars of damage each year in the U.S. and around the world.

Dr. Kodur has published results from his research in 550+ peer-reviewed papers in journals and conferences, and has given 110+ plenary/key-note presentations at major international conferences and meetings. He is one of the highly cited authors in Civil Engineering and Fire Protection Engineering disciplines, and as per Google Scholar, he has more than 27,000 citations with an "h" index of 91. He has an outstanding record for international research initiatives and collaborations and has collaborated with top researchers and prestigious organizations from about two dozen countries to produce high quality deliverables.

Dr. Kodur has served in various leadership positions, including as Chairperson (Head) and Associate Chairperson of the Department of Civil and Environment Engineering at MSU, and as Chair of various technical committees and editorial boards of journals from leading professional societies. Most recently he has been elected to be the Chairperson of the steering committee of the international organization-"Structure in Fire". In recognition of his contributions, he has been elected as Fellow of eight Institutes and Academies; including Academy of Sciences of the Royal Society of Canada, National Academy of Sciences-India, Canadian Academy of Engineering, American Society of Civil Engineers, and Indian National Academy of Engineering. Dr. Kodur is also the recipient of distinguished awards, such as 'NATO award for collaborative research', 'Govt. of Canada (NRCC) Outstanding Achievement Award', and 'Fulbright Scholar' award. Dr. Kodur also holds prestigious appointments including, "Distinguished Invited Visiting Professor" at EWHA Woman's University, South Korea; "INFOSYS Distinguished Visiting Chair Professor" at the Indian Institute of Science; Distinguished Visiting Professor at the Indian Institute of Technology-Bombay; Government of India "VAJRA Faculty (Award) for Collaborative Research" at the Indian Institute of Technology-Delhi and "Adjunct Professor" at the University of Waterloo, Canada. Most notably, Dr. Kodur was part of the Federal Emergency Management Agency and American Society of Civil Engineers high profile "Experts Team" that investigated the collapse of the World Trade Center buildings as a result of September 11 terrorist attacks.

Structural Evaluation of a Historic Wooden Building Using 3D Laser Scanning

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The increasing frequency of climate change has heightened the demand for structural stability assessments of aging buildings. In particular, the importance of ensuring the structural safety of historic buildings is emphasized. Nevertheless, current evaluation practices continue to rely on manual measurement-based investigation methods, which often lack objectivity. To address these limitations and enhance both the objectivity and reliability of structural assessments, this study proposes an advanced evaluation methodology for heritage buildings. Structural capacity assessments of wooden architectural members were conducted using 3D laser scanning. High-density point cloud data was optimized to reflect both surface cracks and geometric irregularities, enabling a close approximation of the actual geometry of the structural members. Finite element analyses were conducted to compare the structural capacities associated with different cross-sectional shapes and volumes. Based on these results, an optimal effective cross-section was derived, fully incorporating the actual crack characteristics and geometric irregularities identified in the structure.

Young K. Ju, a professor at Korea University, received a bachelor´s degree in architectural civil engineering from Korea University, Seoul, South Korea, in 1991, the M.S. degree in structural engineering in 1993, and the Ph.D. degree in structural engineering from Korea University in 1999. In 1995, he joined Daewoo Institute of Construction Technology as a senior researcher. He worked as a postdoc research associate at the University of Texas at Austin from 2003 to 2005. In 2005, he joined RIST (Research Institute of Industrial Science and Technology) as a senior researcher. In 2007, he finally joined the school of civil, environmental and architectural engineering at Korea University as a professor.

Dr. Young K. Ju is the director of the Building Forensic laboratory of Korea University. This lab research building forensic technology that monitors the structural condition in early stages, AI-based Seismic Performance Prediction and Assessment and performance-based design such as Fire resistance, Seismic Resilience and Composite structural member. He has published more than 61 SCI(E) indexed papers for structural engineering.

Applications of Artificial Neural Networks for Anomaly Detection in Various Structures

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Rational structural health monitoring (SHM) is essential for ensuring the safety and reliability of large-scale infrastructures. In recent years, a wide range of advanced technologies has emerged in this field, among which artificial intelligence (AI)–aided methodologies have shown significant promise, particularly for handling complex and diverse datasets. This presentation introduces effective AI-based data-driven anomaly detection techniques capable of recognizing structural behavior patterns under both intact and damaged conditions. By leveraging artificial neural network algorithms, the proposed approaches enable robust pattern recognition and improved diagnostic capability. Various applications for land-based and offshore infrastructures are demonstrated, supported by experimental validation results as well as numerical simulations.

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, and AI-based smart structural monitoring technologies, and effective construction safety technologies. He has published more than 100 SCI(E) indexed papers for structural engineering.

Disaster Risk Management in Cultural Heritage: Principles

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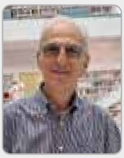
This presentation examines the conceptual framework and operational procedures that underpin Disaster Risk Management (DRM) for cultural heritage. It focuses on the systematic approach required to anticipate, understand, and address threats that may endanger historic buildings, artefacts, and cultural ensembles. The session begins by outlining the DRM cycle, with particular emphasis on the preparatory phase, where risk assessment becomes the principal tool for informed decision-making.

The lecture explores the foundational step of establishing the context, which involves setting clear objectives, defining assessment boundaries, and determining evaluation criteria. It also includes the collection and organisation of essential information, the compilation of damage zoning maps, and the development of structured instruments such as tailored tables, checklists, and questionnaires. These preparatory elements form the basis for the identification of risks. Various categories of risk agents—ranging from natural and environmental risks to human-induced threats and management shortcomings—are introduced, along with the individual risks associated with each. The distinction between sudden, high-impact event risks and slowly developing cumulative risks is highlighted to illustrate the breadth of potential risks affecting heritage.

Attention then turns to methodologies for analysing risks, with particular reference to the ABC method, shaped through international collaboration and subsequently adapted for heritage complexes with multiple structures and assets. The evaluation stage is presented through the concepts of risk magnitude, prioritisation criteria, and the use of MR Priority Graphs as decision-support tools. Approaches to risk treatment are then outlined, drawing on the principles of enclosure layers and stages of control to guide the selection and implementation of suitable interventions. The presentation concludes by underscoring the importance of continuous monitoring and periodic review, ensuring that risk management strategies remain adaptive, effective, and aligned with evolving conditions.



Mehrdad Hejazi is a Professor of Structural Engineering and Architectural Heritage in the Department Civil Engineering, University of Isfahan, Isfahan, Iran. He is the Vice-President of ICOMOS ISCARSAH (International Scientific Committee on the Analysis and Restoration of Structures of Architectural Heritage). He is an expert member of ICOMOS-ISCARSAH, and the chief advisor to the Iranian Ministry of Cultural Heritage, Handicrafts and Tourism. He is the first scholar who has investigated Persian architecture from a structural engineering viewpoint and has published six books and more than 70 journal papers and 120 conference papers, mostly on this subject. He is an expert in the structural analysis, assessment and restoration of Persian historical buildings made of adobe and brick masonry. He has been the director of structural restoration of a number of National and World Heritage Sites in Iran.

Recently, he has been working on scaled laboratory tests on traditional materials, re-design of traditional gypsum-based and lime-based mortars of a few centuries old, disaster risk management plan (DRMP) of World Heritage Sites, and fire risk assessment and management plan (FRMP) of World Heritage Sites.

Mehrdad Hejazi is the Director of the "UNESCO UNITWIN Network on Structural Restoration and Disaster Risk Management of Architectural Heritage" in the University of Isfahan in 2025. This Network unites the expertise of 10 universities, 2 intergovernmental organisations and 1 governmental entities spanning 11 countries across Asia, Africa, South America, and Europe.

Masonry Structures and a Heritage Case Study of a Korean Stone Pagoda

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Masonry is one of the oldest structural materials, yet unreinforced masonry (URM) is highly vulnerable to seismic and extreme loading, often exhibiting brittle failure. Although reinforced masonry systems are now widely adopted, the majority of significant architectural heritage remains URM and demands careful, conservation-oriented assessment and strengthening. This presentation introduces common URM and reinforced masonry systems and highlights challenges in evaluating historical structures.

A central case study is the 1,400-year-old Mireuksaji Stone Pagoda in Korea, a culturally significant granite monument that partially collapsed. To support its restoration, a series of investigations was conducted: material characterization of original stone fragments, three-dimensional numerical analysis using a distinct-element discontinuous modeling approach, and experimental studies on granite strengthened with pinning techniques. Because more than 90% of Korean pagodas were constructed from granite, the results offer broadly applicable insights for the seismic rehabilitation of similar heritage masonry structures.

Thomas Kang, P.E., is a Professor at Seoul National University (SNU). He earned his Ph.D. from the University of California, Los Angeles (UCLA) and his B.S. from SNU. Dr. Kang is a Fellow of the American Concrete Institute (ACI), the Post-Tensioning Institute (PTI), and the Korean Academy of Science and Technology (KAST), and is a member of the National Academy of Engineering of Korea (NAEK).

He has received numerous prestigious awards, including the T.Y. Lin Award from the American Society of Civil Engineers (ASCE) in 2025, the Kenneth B. Bondy Award for Most Meritorious Technical Paper from PTI (twice, in 2012 and 2023), the Wason Medal for Most Meritorious Paper from ACI in 2009, and the Martin P. Korn Award from the Precast/Prestressed Concrete Institute (PCI) in 2023.

Dr. Kang currently serves as Editor-in-Chief of the Journal of Wind & Structures and as Associate Editor of the PTI Journal. His research focuses on the design and behavior of concrete structures and structures incorporating recycled plastics, as well as dynamic effects on structures, including wind, seismic, shock, and fire.

Forensic Assessment and Sustainable Restoration of Vernacular Heritage: The Case of Ushaiger Village, Saudi Arabia

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The Saudi's preservation of vernacular structure poses essential forensic challenges in evaluating both the condition of conservation and structural condition of exposed heritage constructions under climatic, environmental, and anthropogenic agents. This work focuses on Ushaiger Heritage Village, a significant Najdi settlement situated 200 km northwest of Riyadh, and represents centuries of cultural heritage and indigenous building expertise. The study assesses Ushaiger's heritage village buildings and their conditions, identifies structural weaknesses in the archive, and evaluates restoration measures that are useful for sustainable reuse purposes, aligning with national visions such as Saudi Vision 2030 and global standards for heritage risk management.

The adopted methodology tries to mix forensic engineering analysis and architectural conservation strategies to restore mud brick buildings. A systematic site survey was conducted throughout the village's building inventory, recording parameters of accessibility, use, conservation condition, and building material. Every building was typologized using standardized parameters, including accessibility, structural and conservation conditions, and material typologies. This process of mapping helped to appreciate degradation patterns, structural collapses, and possibilities for adaptive reuse. Photographic reports, architectural plans, and geo-referenced mapping of conservation levels in various village zones reinforced the survey.

To complement the forensic study, restoration works were assessed for both ancient practices and recent interventions. It was analyzed thermally, functionally, and for material compatibility with the existing structure, specifically for the masonry works made of mud brick, palm beam roof structures, and lime-based renders, using results from earlier material life-cycle studies. The survey describes that such interventions, which involve a significant amount of cement-based mortars or reinforced concrete additions, are detrimental to the structural authenticity, prone to moisture ingress, and disrupt the thermal balance of historic residences. In sharp contrast, all the restoration works using ancient earthen technology demonstrated higher durability, lower embodied energy, and greater community acceptability, aligning more closely with the notion of sustainable approaches to conservation.

Results indicate that roughly half of the surveyed buildings of Ushaiger are in a fair to a deteriorated condition, with localized collapses of walls, roofs, and facades. Structural weaknesses are typically attributed to loss of maintenance of adobe walls, erosion due to flash flooding, and incompatible forms of repair. Community-driven restoration works, however, have exemplified good practices, such as replastering with local clay, upgrading court drainage, and partial structural rebuilds with assured ongoing use. These findings again highlight the significance of forensic approaches to discriminating between reversible deterioration and irreversible collapses, to inform customized intervention priorities. The integration of forensic engineering surveys with sustainability-led restoration thresholds presents an innovative methodological framework for heritage management.

The research concludes that Ushaiger Village demonstrates both sensitivity and durability of vernacular settlements when analyzed under forensic lenses. Through diagnostic physical surveys, material analyses, and restoration case study reviews, the reserach aims to adopt a consistent methodology to be applied to practical protocols for prioritizing interventions, aiding in municipality-level decision-making, and ensuring long-term structural and cultural durability. The methodology can serve as a transferable template for heritage sites within Saudi Arabia and similarly arid regions, contributing to the international debate on the forensic engineering of heritage sites.

Silvia Mazzetto is an Associate Professor of Architecture and Director of Research of the College of Architecture and Design of Prince Sultan University, Riyadh, who heads the Sustainable Architecture Lab (SALab). Dr. Mazzotto holds an M.Arch and Ph.D. in Architecture from IUAV University of Venice, Italy. Her reserach is focused on sustainable heritage preservation, forensic analysis of historic buildings, and adaptive reuse approaches supporting Saudi Vision 2030. She publishes extensively in peer-reviewed journal publications, such as Heritage and Sustainability. Recent works on Ushaiger Village include studies on structural integrity, restoration materials, and sustainable reuse. Dr. Mazzetto has long-standing experience in teaching and professionalism in Europe and the Middle East, and she works with global networks on cultural heritage, risk management, and sustainable cities.

Heritage Railway Masonry Viaduct: A Case of Multidisciplinary Approach in Protection

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In this lecture, a case study of an unjustified reconstruction of a heritage masonry viaduct will be presented. The damaged historic nineteenth century railway viaduct, located at the Dietla Street in Krakow, Poland, was subjected to deep expertise, aiming at adaptation of it to new railway standards. The Grzegórzecki Viaduct was protected by the law against demolishing by its location on the Polish register of monuments. To protect it against a planned demolition for reconstruction during construction works, a multi-disciplinary team was appointed, consisting of conservators, engineers and scientists. New safety railway standards and heritage conservation needed for the viaduct to be met in their upgrade, which has led to elaboration of evaluation experiments and adjusted reconstruction program. Deep multi-disciplinary investigation was carried out on the viaduct by the team, resulting in a compromise design, based on a multi-volume expert study, accepted by all authorities and stakeholders. The study followed the ISCARSAH guidelines, focusing on minimum intervention.

The heritage status of the Grzegórzecki Viaduct was however removed by withdrawing it from the register of monuments, allowing thus for the viaduct demolition and further reconstruction of it in the initial form, as a reinforce concrete structure with masonry cladding. The Grzegórzecki Viaduct had not been saved. The historic bridge was lost for good: this despite the very many professionals who tried, without success, to prove that alternative theoretical calculations may well prove that the bridge can be improved by strengthening methods, with a result where new capacity would exceed the required design load.

This lecture will present the special dilemmas posed by the maintenance of railways heritage as operational systems and the elaborated solutions for the monument protection. It will also reflect on the personal experiences of the authors with this case study.

Arkadiusz Kwiecień has been working at the Cracow University of Technology since graduating in 1995 at the Faculty of Civil Engineering. He defended his doctorate in 2002 on the dynamics of underground structures. After his PhD, he scientifically developed an original method of repairing structures using polymer flexible joints, working as an assistant professor. In 2013, he became an associate professor, and in 2015 a professor of the Cracow University of Technology. From the beginning of 2021, he has the title of full professor.

In 2016, he founded the FlexAndRobust System spin-off company at the Cracow University of Technology and became its CEO. For many years, he has been conducting international scientific cooperation in the field of research on the use of polymer flexible joints in concrete, masonry and wood construction, with particular emphasis on composite reinforcements. The solutions developed by him have proved their effectiveness in anti-seismic engineering.

He is the author or co-author of over 220 scientific publications and over 50 expert opinions for the industry. He has conducted several national and international research projects. He is active as a member of ICOMOS and ISCARSAH, as well as the RILEM and COST Action committees.

Documenting and Studying the First Indigenous Peoples of South Africa's Tangible and Intangible Heritage Applying an Indigenous Methodology

Magda Minguzzi
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This contribution speaks about research projects developed at the Nelson Mandela University School of Architecture, with the aim to document, study, and raise awareness on Indigenous tangible and intangible heritage, located in the Eastern Cape province of South Africa and never studied before. Those are examples of vernacular architecture, where the Indigenous knowledge systems applied to build, has been passed down from generation to generation from pre-colonial times up till the present, despite the long history of segregation and displacement from their territory suffered by the First Indigenous Peoples -the San and Khoikhoi - starting from the arrival of the settler colonisers.

The working group involved in those projects, composed by academics and Indigenous leaders, was formed by Minguzzi in 2015, under the umbrella of Nelson Mandela University. Since then, there has been a continuous development of research projects done by the group which involved teaching-learning-researching to explore and promote "practices of cultural re-appropriation". These projects aim to reconnect the San and Khoikhoi to their heritage sites and to reformulate and reconstruct their indigenous narrative and history, done by them.

The research methodology in use has its foundations in the holistic indigenous worldview. This ethically sound process is rooted in principles of mutual trust and accountability, respect for each other's views and cooperation in the research decision process, reciprocal knowledge product appropriation, and use of Indigenous protocols toward the right of Indigenous Peoples to retain full control of their knowledge.

The core phases of the research projects and the methods applied will be discussed with a specific focus on the relationship and involvement with the First Indigenous Leaders and community members in the process of investigation.

Magda Minguzzi, an associate professor at Nelson Mandela University School of Architecture, received her Ph.D. in Architecture from Iuav University of Venice in 2009.

Since 2013, she has been lecturing and leading research at Nelson Mandela University School of Architecture, South Africa. In addition, Dr. Minguzzi is a researcher at the Institute for Coastal and Marine Research (CMR) at Mandela University, thanks to her ground-breaking research on Indigenous fish traps. Since 2024, she has been a C2-rated researcher at the National Research Foundation of South Africa.

Dr. Minguzzi is a member of several international organizations such as ICOMOS-ICHAM (2017) and "Indigenous People, Traditional Ecological Knowledge, and Climate Change: The Iconic Underwater Cultural Heritage of Stone Tidal Weirs" (2021).

She has received several awards for her research in partnership with the First Nations of South Africa, and in 2025, she was shortlisted for the prestigious National Science and Technology Forum (NSTF) Awards in the 'Researcher' category.

Her work has been published in national and international peer reviewed journals and books. She recently published (2025) her book 'ORIGINS, KhoiSan Heritage Sites in the Eastern Cape, South Africa' with Mandela University Press. In 2021, she published 'The Spirit Of Water: Practices of cultural reappropriation. Indigenous heritage sites along the coast of the Eastern Cape-South Africa' with FUP Florence University Press (open access).

She has produced several creative outputs , including four documentaries. Her most recent work, Building a Matjieshut - Haru Oms, Building a Village, is available at https://youtu.be/32kIHjkRd6U?si=8y-kqeKMOIJYESI7

Conservation-Oriented 3D and Thermal Imaging Study of the Historic Vault Polychrome in St. Mary's Basilica, Krakow

Izabela Joanna Drygala
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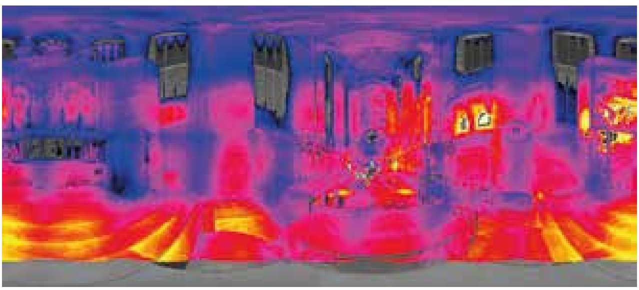
The study presents the results of a non-destructive and non-contact investigation of the polychrome covering the vault in the main presbytery of St. Mary's Basilica in Krakow. As one of the most prominent monuments of Polish Gothic architecture and a UNESCO World Heritage Site, the St. Mary's Basilica requires careful and innovative monitoring approaches to support long-term preservation. Advanced 3D scanning and infrared thermography were employed to ensure reliable assessment without physical interference. A geometric inventory of the vaulting was first prepared using 3D laser scanning. Subsequently, thermal maps of the polychrome surface were analysed to identify areas of potential detachment and discontinuity. The study demonstrated that zones with consistent temperature distribution indicated stable adhesion, while local anomalies revealed areas requiring closer conservation attention. The integrated methodology enabled a preliminary yet precise evaluation of the conservation state of the vault polychrome, providing valuable support for ongoing and future preservation strategies.



(a) Thermal image showing temperature distribution on the vault and wall surfaces

(b) Corresponding optical image of the interior

Figure 1. Panoramic views of the main presbytery of St. Mary's Basilica in Krakow

Izabela Joanna Drygała is a graduate of the Cracow University of Technology (Poland), where she completed her bachelor's degree in civil engineering (specializing in Bridges and Underground Structures) in 2011, followed by a master's degree in 2012. In 2016, she obtained a Ph.D. in Technical Sciences in the field of Civil Engineering, based on her dissertation titled "Dynamic Response Analysis of Footbridges to Seismic and Paraseismic Excitations". She has been professionally affiliated with the Cracow University of Technology since 2012 and currently works as an Assistant Professor in the Chair of Structural Mechanics and Materials. She holds a professional engineering license for bridge design without restrictions in Poland. Her research focuses on dynamic interactions affecting civil structures, including anthropogenic seismicity and bridge dynamics. Her scientific work combines advanced numerical analyses with in-situ investigations, resulting in practical solutions for the design and safety assessment of engineering structures. She has completed research fellowships abroad, including at the University of Waterloo (Canada) and the Sapienza University of Rome (Italy). She collaborates with research institutions in Italy, Slovenia, Canada, and Switzerland, actively participating in international research projects. Since 2017, she has also served as an expert for the European Commission's Research Executive Agency. Dr. Drygała is a member of several national and international scientific and engineering organizations, including: Polish Group of Seismic and Paraseismic Engineering (since 2015), International Association for Bridge and Structural Engineering – IABSE (since 2017; as of 2025, a member of Commission 1 – Performance and Requirements), Małopolska Regional Chamber of Civil Engineers (since 2023), Sigma Xi (since 2023), American Society of Civil Engineers – ASCE (since 2024), Bridge Engineering Institute (since 2024), and Polish Academy of Sciences, Committee on Transport – Section VI on Environmental and Social Impacts of Transport (from 2025).

The Sanctuary by the Western Walls of Paestum: Histories of Collapses and Structural Failures

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A sanctuary built in the 6th century BC has recently been uncovered along the western fortifications of Paestum, a few hundred meters from the sea. Architectural remains attest to the presence of two Doric temples—Archaic and Late Archaic in date—whose use continued uninterrupted through the Lucanian and Roman phases until the early Imperial period. After the abandonment of the sacred area, the collapse of a section of the inner curtain wall also affected the western façade of the Late Archaic temple.
The research adopts an interdisciplinary methodology, integrating archaeological, architectural, and engineering perspectives. Three-dimensional surveys, stratigraphic analysis of the masonry, mapping of collapse features, and digital modeling were carried out to investigate the possible kinematic mechanisms underlying the observed structural failures. Advanced survey techniques were employed, including active sensors (Terrestrial Laser Scanner) and passive sensors (drone-based photogrammetry), to achieve high-resolution geometric documentation of the site.
The analysis suggests that the main instability factors were likely associated with local seismic amplification, passive thrust of water-saturated backfill soils, and the loss of structural continuity within the masonry due to localized settlement, especially in the area under investigation.
The results contribute to a deeper understanding of the stratigraphy and transformation of the sanctuary, as well as to the structural vulnerabilities of the city walls. They also provide a technical basis for planning future actions of maintenance, restoration, preventive conservation, and monitoring, consistent with the archaeological significance of the site.

Professor **Luigi Petti** is a faculty member in the Department of Civil Engineering at the University of Salerno, Italy. He received his Ph.D. in Earthquake Engineering from the University of Salerno in 1993, following a research period at the University at Buffalo (SUNY), USA, where he worked on innovative seismic design approaches.

His research activities focus on the dynamic behavior of complex structures; seismic risk assessment and management of complex sites and constructions; vulnerability assessment of existing structures and cultural heritage; advanced methods to enhance the seismic performance of both existing and new structures; and structural health monitoring of complex systems and heritage assets.

He previously served as General Secretary of ICOMOS IT-NC (the International Scientific Committee on Sites and Monuments, a UNESCO advisory body) and is currently an expert member of ICORP, the International Scientific Committee on Risk Preparedness of ICOMOS.

He is the scientific lead for the high-level surveillance of bridges, viaducts, and tunnels on the Italian highway network, and oversees the monitoring and safety assessment of UNESCO World Heritage sites, including Pompeii and Paestum.

As an expert in the monitoring and safety evaluation of built heritage, he is actively involved in international projects, including initiatives in Basra (Iraq), Isfahan (Iran), Beijing (China).

Application of the Artificial Neural Networks on the Structural Health Monitoring for the Offshore Structures

Dominika Kuśnierz-Krupa, Michał Krupa
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Zakopane is one of Poland's historic health resorts. It is home to many historic wooden buildings, which are in varying states of repair and subject to different levels of conservation protection. In this presentation, we will present the results of research on the condition of selected wooden spa villas. The following aspects were analyzed: the history of the buildings, their architectural style and period of construction, technical condition, and current form of conservation protection. On this basis, priority tasks were identified for the restoration of these buildings, which often simply involves saving them. Overall, the current condition of the architecture and cultural landscape of this town is poor. On the one hand, there is still a large stock of historic buildings in Zakopane, but on the other hand, in many cases they are poorly adapted, poorly managed, and not renovated, which not only causes them to lose their historic value but also affects the historic value and cultural landscape of the entire health resort. According to the authors, control and a consistent conservation policy by the Provincial Conservator of Monuments for this area, with the substantive support of experts from the Minister of Culture and National Heritage, is currently a priority for the survival of historic Zakopane.

Dominika Kuśnierz-Krupa, professor at Cracow University of Technology, received the M.S. degree in architecture and urban design from Cracow University of Technology, Faculty of architecture, in 2003, the M.S. degree in landscape architecture in 2006, the Ph.D. degree in architecture and urban design from Cracow University of Technology in 2010 and the DSc degree in architecture and urban design from Cracow University of Technology in 2015. She received the scientific title of professor in architecture and urban design in 2020. Dominika Kuśnierz-Krupa works in a research and academic position at the Chair of history of architecture and monument preservation from 2004 until now. For 20 years, together with her partner, she has been running her own design studio, which designs residential, sports, public, and cultural buildings. She is a member of the National Chamber of Polish Architects; ICOMOS; Association of Monument Conservators; Urban History Association; International Planning History Society and Association of Polish Town Planners. She specializes in conservation of architectural and urban monuments; protection and conservation of historic cities; history of architecture and urban planning and protection of cultural landscapes. Dominika Kuśnierz-Krupa is the author of 5 scientific monographs and more than 140 papers. She also conducts expert activities, holding the qualifications of an expert appointed by the Minister of Culture and National Heritage and an expert appointed by the Association of Monument Conservators.

Michał Krupa, Associate professor at Cracow University of Technology, received the M.S. degree in architecture and urban design from Cracow University of Technology, Faculty of architecture, in 2003, the Ph.D. degree in architecture and urban design from Cracow University of Technology in 2012 and the DSc degree in architecture and urban design from Cracow University of Technology in 2018. Michał Krupa is a researcher at the Cracow University of Technology, Faculty of Architecture, Department of Housing Environment Design, Dean's Representative for Cooperation with Local Authorities and the Business Community in Poland and Abroad, and a member of the Municipal Urban Planning and Architecture Commission of the City of Cracow. His academic achievements include over 90 published scientific papers, including two monographs, numerous articles in international scientific journals, and chapters in monographs. Michał Krupa has also participated in dozens of international conferences, symposia, and five international scientific projects. He is a member of organizations and associations such as the Association of Polish Architects, the Association of Monument Conservators, the Małopolska Regional Chamber of Architects of the Republic of Poland, the Urban History Association, and the European Architectural History Network. His research interests focus primarily on studies related to the impact of cultural heritage on contemporary urban planning and architecture. He has been running a design office for over 20 years. He is the author and co-author of numerous architectural design documentation for public buildings, such as theaters, sports halls, administrative buildings, as well as residential buildings and the adaptation and restoration of historic buildings.

Structural Restoration of the Wooden Veranda of the World Heritage Building of Ali Qapu in Isfahan

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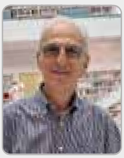
The Ali Qapu Palace in Isfahan, a UNESCO World Heritage Site, features a prominent wooden columnar talar (veranda) facing the Naqsh-i-Jahan square. This presentation details the structural and anti-seismic interventions implemented across two major restoration campaigns spanning the last six decades. The first extensive restoration, conducted in the 1960s and 1970s, primarily focused on addressing the dangerously compromised masonry structure of the main building. These initial efforts, while comprehensive for the masonry, only partially addressed the wooden columnar structure, being limited to strengthening six of the eighteen main sycamore columns using embedded square-shape steel profiles.

The second and more focused restoration campaign, carried out between 2005 and 2017, concentrated specifically on the structural rehabilitation of the wooden talar and its supporting veranda. The primary objectives were to repair damaged wooden elements and significantly enhance the structure's overall integrity and lateral load resistance. Key interventions included extending the earlier strengthening method to the remaining wooden columns by stiffening by steel profiles. The column support and connection systems were also stiffened using new foundations.

Crucially, the 2005–2017 work introduced a new, comprehensive lateral load bearing system to improve the building’s seismic performance. This system involved adding a horizontal steel cable bracing network within the roof structure of the talar. Furthermore, the floor of the veranda was lightened, and the decorative hanging ceiling was secured with additional steel hangers.

This presentation systematically explains these phased interventions, illustrating the transition from initial masonry rehabilitation to the comprehensive structural and anti-seismic upgrade of the wooden talar. While these restoration works have retrieved the integrity of the palace, the paper concludes by stressing the need for a future comprehensive seismic assessment to quantify the effectiveness of the implemented measures.



Mehrdad Hejazi is a Professor of Structural Engineering and Architectural Heritage in the Department Civil Engineering, University of Isfahan, Isfahan, Iran. He is the Vice-President of ICOMOS ISCARSAH (International Scientific Committee on the Analysis and Restoration of Structures of Architectural Heritage). He is an expert member of ICOMOS-ISCARSAH, and the chief advisor to the Iranian Ministry of Cultural Heritage, Handicrafts and Tourism. He is the first scholar who has investigated Persian architecture from a structural engineering viewpoint and has published six books and more than 70 journal papers and 120 conference papers, mostly on this subject. He is an expert in the structural analysis, assessment and restoration of Persian historical buildings made of adobe and brick masonry. He has been the director of structural restoration of a number of National and World Heritage Sites in Iran.

Recently, he has been working on scaled laboratory tests on traditional materials, re-design of traditional gypsum-based and lime-based mortars of a few centuries old, disaster risk management plan (DRMP) of World Heritage Sites, and fire risk assessment and management plan (FRMP) of World Heritage Sites.

Mehrdad Hejazi is the Director of the "UNESCO UNITWIN Network on Structural Restoration and Disaster Risk Management of Architectural Heritage" in the University of Isfahan in 2025. This Network unites the expertise of 10 universities, 2 intergovernmental organisations and 1 governmental entities spanning 11 countries across Asia, Africa, South America, and Europe.

Flood Risk Management Using AI-CCTV

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Recent flood research increasingly applies computer vision to infer inundation extent, water depth, and discharge from visual observations. flood mapping, exposure detection, and image velocimetry (OF/LSPIV) demonstrate that key hydraulic variables can be derived directly from imagery. Given the widespread availability of riverside CCTV, such methods show strong potential as deployable non-structural flood risk management. However, most studies remain task-specific experiments, lacking integration between hazard assessment and hydraulic quantification needed for comprehensive flood management, while the reliability of field-scale image velocimetry has not been fully examined.

We present an AI-CCTV framework consisting of three components: (1) the KU River Dataset, (2) an integrated hazard assessment model, and (3) a reliability-based image velocimetry framework. First, we construct the KU River Dataset across 96 gauging stations in five major basins and develop a Yeongsan River video acquisition pipeline collecting over 90,000 video clips annotated with spatio-temporal water-level and discharge metadata. Second, we propose an integrated hazard assessment model that performs flood-extent inference via waterbody segmentation and couples it with human/vehicle exposure detection for comprehensive flood hazard alert. Finally, we introduce a reliability-based image velocimetry framework using OF/LSPIV to assess the stability of image-based velocities and to compare discharge estimates with field observations.

This presentation follows an omnibus format, with three speakers sequentially outlining how these components operate as a unified AI-CCTV system for operational flood risk management.

Donghwi Jung is an Associate Professor in the School of Civil, Environmental and Architectural Engineering at Korea University. He received his B.S. and M.S. from Korea University and his Ph.D. from the University of Arizona. His research centers on integrating artificial intelligence, metaheuristic optimization, and water resources engineering, with particular interest in sustainable design and management of urban water systems. He has developed optimization and deep-learning frameworks for water distribution analysis, flood detection, and segmentation, and his work has been published in leading journals including Water Research and the ASCE Journal of Water Resources Planning and Management.

Jinyong Kim is a research engineer at the Future and Fusion Lab of Architectural, Civil and Environmental Engineering (f-ace lab) at Korea University. He holds a bachelor's degree in Language, Brain & Computer (LB&C) Convergence from Korea University. Previously, he worked on alignment red-teaming for Naver Clova X and is currently conducting research on image-based flood hazard assessment.

Sohee Kim is an integrated Master–Doctoral student in the Department of Civil, Environmental and Architectural Engineering at Korea University. She received her B.S. degree from Korea University. Her research centers on reliability-aware image velocimetry, with a focus on developing automated frameworks for estimating river surface velocity and inferring discharge from real-world CCTV observations.

Flood Warning in Thailand: Current Situation and Research

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Flooding, intensified by climate change, necessitates advanced prediction models. Traditional hydrodynamic simulations, HEC-RAS 1D/2D are computationally intensive, limiting real-time flood forecasting. This study proposes an integrated deep learning framework to emulate HEC-RAS 1D/2D, significantly reducing computational demands. The framework comprises an LSTM for river water level prediction and a CNN for flood inundation mapping. To ensure physical consistency, the CNN learns the relationship between river water levels and flood inundation by mimicking overflow results of 1D/2D models. Training uses observed hydrological data and flood inundation maps from 1D/2D simulations. Results indicate the LSTM achieving good accuracy to predict water level. The CNN effectively translates water level predictions into flood depth maps, demonstrating close agreement with HEC-RAS outputs. Overall, the AI-based framework significantly accelerates flood simulations while maintaining high accuracy, making it a promising tool for real-time flood prediction and large-scale flood risk assessment.

Chaiwat Ekkawatpanit is an Assistant Professor in the Department of Civil Engineering at King Mongkut's University of Technology Thonburi (KMUTT), Thailand. He previously served as the Associate Dean for Industrial Partnership and Special Affairs at the Faculty of Engineering. Dr. Chaiwat received his B.Eng. in Water Resources Engineering from Kasetsart University (Thailand), M.Eng. in Water Resources Engineering from King Mongkut's University of Technology Thonburi (Thailand), and Ph.D. in Civil and Environmental Engineering from Tohoku University (Japan). He has been a faculty member in the Civil Engineering Department at KMUTT since 2002. He actively contributes to the profession, serving on several national committees, including the Thai Hydrologist Association and Association and the Water Resources Engineering Subcommittee under the Engineering Institute of Thailand.

Dr. Chaiwat has published extensively in peer-reviewed journals, book chapters, and conference proceedings. His primary research interests focus on water resources management, including flood and drought assessment, water conflict, and the impacts of climate change on water resources, as well as adaptation strategies.

Hydro-Informatics in Indonesia: An Academic Perspective

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We, at some level, agree that in order to tackle complex water-related challenges in engineering, management, and governance, hydro-informatics is a key. It leverages information and communications technologies (ICT) incorporated trans-disciplines optimization and simulation models. Hydro-informatics in Indonesia has been supported by strong water laws and solid ideas; however, its development has been implemented slowly. The vast area of the country and the widespread, complex water systems were the biggest factors that make this even more difficult.

However, some projects and initiatives have emerged and promise progress. Youth engagement in smart water, local inclusion in water problem solver, university or government projects on modernization and catchment-scale support systems are some of the things I would like to share. These are five lessons learned that can be advocated for adoption in developing countries or those approaching developed status:

1. Promote Interdisciplinary Training and Invest to Youth
2. Local Adoption & Capacity
3. Invest in Optimum Infrastructure (HPC, Instruments, ICT)
4. Data Quality over Quantity
5. Open Data and Develop Assimilation System

The lecture acknowledges my colleague, Dr. Faizal Rohmat, for his fruitful research collaborations over the past several years.

Hadi Kardhana belongs to Faculty of Civil and Environmental Engineering at Institut Teknologi Bandung, Indonesia. He had served as a Vice Dean and teach hydrology on several programs under the faculty. Hadi received his bachelor's degree in in civil engineering with specialty in water resources engineering from Institut Teknologi Bandung in 2000 and his master's degree on same programs in 2005 while working on several water infrastructure project in Indonesia. He initiated his work in water science with hydraulic modeling, progressed to turbulent modeling, and ultimately specialized in hydrologic modeling. He pursued doctoral program in Tohoku University, Japan at Disaster Potential Research Laboratory in 2005 and received his Ph.D in 2008 from his works on Flood Forecast based on Numerical Weather Prediction. He return to Indonesia as a lecturer in Institute Technology Bandung on 2010 and continue to profess as hydrologist. He is a fellow of the Hydraulic Association and Hydrology Association of Indonesia. He published more than 60 articles and conference papers. His research interests are on flood forecast, machine learning model, distributed rainfall-runoff model, rainfall and discharge prediction, hydro-potential analysis, early warning support system, surface and subsurface water interaction, and low flow analysis. He also works on inventions on algorithm, smart instruments, rainfall catcher, rainfall simulator, and green pavement.

Forensic Investigation of Incidents in Embankment Dams

DongSoon Park
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Dams are globally recognized as among the most aging civil infrastructure, highly vulnerable to climate change and natural hazards, often resulting in catastrophic consequences upon failure. This case study aims to share the findings of a forensic study investigating the phenomena and root causes of incidents across seven embankment dams. The cases include the 2017 near-failure of the Oroville Dam spillway in the United States, a 2019 tailings dam collapse in Brazil, and five separate earth-cored embankment dam incidents in South Korea. The Oroville incident was attributed to a combination of cavitation from high-velocity discharge and the deterioration of the concrete slab-bedrock interface due to over 50 years of aging. The Brazilian tailings dam failure was investigated and confirmed to be caused by static liquefaction. The five Korean dam incidents exhibited diverse phenomena, including sinkholes, a liquefied core, downstream slope wetting, and slope failure, with a common observation of compromised impervious function in the clay cores. Geotechnical and geophysical investigations revealed that the deterioration was heterogeneous and anisotropic, mainly resulting from insufficient compaction, material defects, and complex geomechanical interactions. A core finding is that the severity of damage correlates with the extent of defect distribution within the core material. The study emphasizes the necessity of rapid, staged investigations when key signs of seepage-related incidents are detected. For aging dams with inadequate design records, proactive and direct subsurface investigations are urgently needed. The case studies and analyses presented here provide critical reference material for applying risk mitigation techniques in the upgrading and rehabilitation of aging dams.

Park, DongSoon is the head researcher at the K-water Research Institute in South Korea and currently a secretary-general of Korean National Committee on Large Dams (KNCOLD). He was a visiting scholar at Stanford University's Department of Civil & Environmental Engineering. He received his Ph.D. in Civil and Environmental Engineering from the University of California, Davis in 2011, with a major in geotechnical engineering and a sub-major in river engineering. Dr. Park's work experience is primarily in research and consulting in the areas of water infrastructure safety, dam engineering, geotechnical and geotechnical earthquake engineering at the K-water Research Institute. He is actively involved in global dam safety collaborations. Dr. Park's current research interests include digitalization of water infrastructures, as well as advanced geotechnical (earthquake) engineering for dams, levees, and lifelines. He has authored many influential journal papers and has been the PI of important research projects, receiving multiple awards for his contributions to academia and industry.

Forensic Engineering of Urban Flash Floods in Sylhet: Causes, Impacts, and Data-Driven Mitigation

Shabbir Ahmed Osmani
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This presentation focuses on how forensic engineering can be used to understand the true causes and impacts of flash floods and how data-driven approaches can help reduce future risks. Flash floods in cities like Sylhet are becoming more severe due to rapid urbanization, inadequate drainage, land-use changes, and extreme rainfall events. Forensic engineering provides a structured way to investigate these events by examining failed infrastructure, blocked drainage pathways, altered catchments, and human activities that intensify flooding. The presentation outlines various tools used in forensic flood investigations, including field surveys, GPS mapping, flow measurements, community interviews, drone imagery, satellite-based remote sensing, and GIS analysis. These tools help reconstruct flood pathways, measure impacts, and identify the root causes of system failures. Data-driven technologies—including machine learning, spatial modeling, correlation analysis, and scenario simulations—are then introduced as modern methods to assess flood susceptibility, identify hotspots, and develop early warning systems. By integrating forensic engineering with advanced analytics, decision-makers can propose effective mitigation strategies such as optimizing drainage design, enforcing better urban planning, incorporating nature-based solutions, and improving maintenance practices. The presentation concludes by emphasizing the need for a combined engineering and data-science approach to build a more resilient Sylhet and provide a model for other vulnerable cities in Bangladesh and South Asia.

Shabbir Ahmed Osmani is an Associate Professor in the Department of Civil Engineering at Leading University, Sylhet, Bangladesh, where he has been serving in progressive academic roles since 2014. He earned his B.Sc. (Eng.) in Civil and Environmental Engineering from Shahjalal University of Science and Technology (SUST) in 2004 and later completed his M.Sc. (Eng.) in the same discipline at SUST in 2018. In 2024, he received his Ph.D. in Climate Interactions from Chung-Ang University, Seoul, South Korea, under the Department of Smart Cities.

His research focuses on climate variability and teleconnections, long-lead prediction of climate indices using machine learning, hydrological and environmental modeling, and remote-sensing–based environmental assessment. He has contributed to numerous research studies and conference presentations on climate interactions, precipitation prediction, and environmental monitoring. His publication record includes peer-reviewed journal articles, international conference papers, and collaborative research outputs in ENSO/IOD teleconnections, precipitation variability, remote sensing applications, and data-driven climate modeling. His recent works include flood susceptibility mapping in Bangladesh and analyzing teleconnections between ENSO behavior and flood events.

Dr. Osmani continues to advance data-driven approaches for understanding global climate drivers and their influence on regional hydrological systems, with a strong emphasis on ENSO, IOD, and rainfall prediction methodologies.

Climate Change and its Impacts on the Large Reservoir Systems

Subbarao Pichuka
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Climate change has altered the frequencies and intensities of rainfall events, posing a significant threat to water infrastructure, particularly dams. As a result, the operation of reservoirs becomes more challenging. Therefore, it is needed to study the revised hydrology of the large reservoir catchments and develop suitable climate change adaptation strategies. The primary objective of this talk is to outline these challenges and assess the projected changes in Probable Maximum Precipitation (PMP) and the corresponding Probable Maximum Flood (PMF) for large reservoir systems in India under different climate change scenarios. The extreme rainfall characteristics were analysed for four major reservoir catchments using Intensity-Duration-Frequency (IDF) relationships. The comparison is made among the IMD observed rainfall data during the baseline period (1951-2014) and corresponding GCM downscaled data, as well as future projected (2015-2100) precipitation for three climate change scenarios (SSP 126, SSP 245, SSP 585) from five CMIP6 GCMs. The findings are further evaluated to assess shifts in rainfall intensities as per 200-year return period magnitudes. Across all reservoirs and models, IDF plots showed a notable increment during the future period, with each model exhibiting a distinct progression from baseline to future scenarios. Changes in extreme event frequencies were examined for two climatic epochs, 30 years each (Epoch-1: 1961-1990 and Epoch-2: 1991-2020), revealing a clear rise in the latest epoch. These trends point to increasingly responsive catchments and heightened flood potential. To evaluate upper-bound flood magnitudes, climate change-induced PMP was derived through delta-factor adjustments, which were then translated into spatial rainfall distributions for each catchment using isohyets. The resulting PMF estimates indicate substantial amplification relative to current design values. The combined evidence from the above assessments demonstrates a consistent intensification of hydrologically relevant extremes across scenarios and models. These findings highlight the need for climate-responsive updates to reservoir design standards, operational guidelines, and safety assessment frameworks as extreme rainfall regimes continue to evolve.

Subbarao Pichuka is an Assistant Professor in the Hydraulics and Water Resources Engineering Division of the Department of Civil Engineering at IIT Madras. He received his M.Tech from IIT Guwahati in 2012 and completed his Ph.D. at IIT Kharagpur in 2019, specialising in hydroclimatology and hydrological extremes. Prior to joining IIT Madras in 2023, he served as an Assistant Professor at NIT Andhra Pradesh (2019–2023) and as a Lecturer at IIIT Basar (2012–2013). He also contributes to the scientific community as a reviewer for leading journals, including Journal of Water and Climate Change (IWA Publishing), Journal of Hydrology, Hydrological Sciences Journal, and Nature Scientific Reports. His research interests include hydrological extremes, climate-driven variability of hydroclimatic variables, Bayesian inference, non-stationary hydrologic modelling, and time-varying downscaling approaches. His work focuses on enhancing the representation of future precipitation, temperature, soil moisture, and hydrological extremes, with specific emphasis on monsoon variability, reservoir inflow behaviour, Dam safety aspects, reservoir sedimentation, streamflow extremes, and urban temperature rise. These themes underpin broader applications in hydroclimatology, integrated watershed management, climate-impact assessment, and sustainable river engineering.

Baseflow Separation and Prediction Using Machine Learning

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Baseflow, the component of streamflow sustained by groundwater and other delayed sources, is a critical indicator of catchment storage and groundwater-surface water interactions. As it cannot be measured directly, empirical hydrograph separation filters are commonly employed. However, these filters rely on ad-hoc parameters that introduce significant uncertainty into the separation results. While calibrating these parameters using environmental tracers effectively reduces this uncertainty, such tracer data are unavailable for the vast majority of global catchments. To overcome this limitation, we present a novel regionalization framework that extends optimized filter parameters to ungauged basins. Using the Random Forest algorithm, we developed predictive models for the parameters of the Smooth Minima baseflow filter based on 82 catchment-scale physical, climatic, and anthropogenic characteristics. The framework was applied and tested across 855 catchments in the contiguous United States. Results demonstrate a strong predictive performance for the key filter parameter. Predictor importance analysis reveals that catchment area is the dominant control, followed by climate indices, hydrological signatures, soil properties, and water usage characteristics. Importantly, in daily baseflow separation, using our regionally predicted parameter yields more reliable estimates than those derived from traditional, area-based power functions. This study provides a robust, data-driven approach to improve the accuracy and reliability of baseflow separation in catchments lacking tracer data. The framework lays a solid foundation for advancing large-scale hydrological analyses and enhances our understanding of streamflow partitioning across diverse landscapes.

Dagang Wang is a professor at the School of Geography and Planning at Sun Yat-sen University. He earned his bachelor's degree in hydraulic engineering from Dalian University of Technology (DUT), China, in 1997, followed by a master's degree in hydraulic engineering from DUT in 2002. He obtained his Ph.D. in environmental engineering from the University of Connecticut, USA, in 2007. Dagang Wang worked as a research associate with Professor Eric Wood at Princeton University from 2007 to 2008. Subsequently, he served as a water resources engineer at Dewberry from 2008 to 2010, and later joined the National Weather Service's National Operational Hydrologic Remote Sensing Center as an associate scientist from 2010 to 2011. He has published over 100 journal papers, including articles in Nature Climate Change, Nature Communications, and Science Advances. His research interests include the application of AI in hydrology and water resources, extreme climate changes, and land surface modeling.

From Pixels to Intelligence: AI-Driven Hydrological Insight for Flood, Drought, and Ecosystem Resilience

Changhyun Jun
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Artificial intelligence (AI) is enabling a new generation of multimodal hydrological observation and predictive assessment systems that transform pixel-level environmental data into actionable intelligence for managing floods, droughts, and ecosystem resilience. This talk highlights recent advances demonstrating how AI extracts hydrologically meaningful information from diverse sensing platforms and converts it into decision-ready insights. Key examples include AI-based image-fusion techniques that integrate radar and numerical weather prediction rainfall fields to improve short-term quantitative precipitation forecasts, along with deep-learning methods that estimate rainfall rates from CCTV infrared imagery under low-light conditions. Additional sensing innovations feature machine-learning models that infer rainfall intensity from acoustic raindrop signatures, providing a scalable, low-cost alternative for dense urban monitoring. Beyond observation, the talk presents AI-powered flood susceptibility mapping that leverages hybrid neural networks and explainable AI to reveal geomorphic and climatic controls on flood-prone areas. Complementary work on climate-informed rainfall scenario generation and drought-related water-supply sensitivity analysis demonstrates how AI supports long-term planning under increasing hydroclimatic uncertainty. Together, these studies illustrate a coherent pathway in which AI fuses multisource environmental data, enhances the characterization of hydrological extremes, and informs resilient water and ecosystem management in a changing climate.

Changhyun Jun is an Associate Professor in the School of Civil, Environmental, and Architectural Engineering at Korea University (KU). He received his B.S. and Ph.D. degrees in Civil and Environmental Engineering and Water Resources Engineering from KU in 2010 and 2014, respectively. He subsequently served as a Postdoctoral Research Fellow at the Hong Kong University of Science and Technology, Politecnico di Milano, and Nanyang Technological University, broadening his international research experience across hydrometeorology and environmental sensing. He began his faculty career in 2017 as a Lecturer (Assistant Professor) at Xi'an Jiaotong-Liverpool University and later joined Chung-Ang University (CAU) before moving to KU in 2019. He currently leads the HydroMeteorology Sciences (HyMetS) group, where his research focuses on AI-driven hydrology, multimodal environmental sensing, hydrological extremes, climate change impacts, and resilient water-ecosystem management. His recent work advances AI-enabled rainfall observation, flood and drought risk assessment, and ecosystem resilience, integrating pixel-level data from radar, satellites, CCTV, acoustic sensors, and reanalysis products. His research aims to improve the understanding of hydrological processes across scales and support climate-resilient urban design and water-sensitive city planning.

System Dynamics Modeling for Water/Transportation Carbon Emissions and Energy Consumption

Yan Zheng
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This study employs a system dynamics model to simulate carbon emissions in the transport industry, with a focus on the impacts of multiple policy interventions and their synergistic effects on emission trajectories. In this model, the complex interdependencies among energy consumption, societal trends, economic drivers, and demographic shifts are thoroughly incorporated. This study examines the efficacy of three principal decarbonization levers for China's transport sector: technological innovation and energy substitution, structural optimization of the transport system, and integrated policy design to harness synergies. Building on these levers, a nine-scenario simulation matrix is developed to quantitatively assess how alternative policy portfolios dynamically shape the trajectories of sectoral energy demand and carbon emissions. Among the nine scenarios, Scenario 8 is characterized as a synergistic scenario that integrates improvements in fuel-powered vehicle efficiency with the optimization of railway freight transport. Specifically, it entails technological upgrading of conventional fuel-powered vehicles to reduce energy consumption per unit mileage, while simultaneously enhancing the spatial layout and scheduling mechanisms of railway freight networks to increase rail competitiveness within multimodal logistics systems. By combining these two strategies, Scenario 8 seeks to reduce dependence on high-carbon transport modes and maximize emission reduction potential. In this scenario, the energy saving rate reaches 24.95 % and the emission reduction rate reaches 37.39 %. This scenario uniquely combines immediate efficiency gains from the legacy vehicle fleet with foundational, long-term structural changes via rail freight optimization. This synergistic approach proves highly effective, substantially reducing the transport sector's emissions and charting an efficient and feasible course toward carbon neutrality. The findings guide recommendations for an optimal decarbonization trajectory. While single measures yield short-term emission reductions, synergistic scenarios integrating technological progress and structural optimization demonstrate higher overall mitigation potential.

Yan Zheng is an Associate Professor at the Department of Automobile and Traffic Engineering at Nanjing Forestry University (NFU). She is currently serving as a Deputy Director at the Transportation Bureau of Qixia District, Nanjing. Yan Zheng received her master & Ph.D. degree in the School of Information and Management Engineering from Korea University in 2014. After graduation, she has been working in NFU, where she is currently an Associate Professor. Her research interests include the operation management and optimization of intelligent transportation systems, route optimization for smart vehicles, sustainable development strategies for low-carbon transportation systems, and intelligent optimization algorithms.

Innovating Open-Source Hydrological Modeling: Streamflow Simulation and Reservoir Operations in the Nam Mu River Basin, Vietnam

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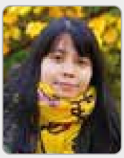
This lecture presents an integrated, open-source hydrological modeling framework developed for streamflow simulation and reservoir operation in the Nam Mu River Basin, Vietnam. The approach begins with applying the Sobol global sensitivity analysis to the SAC-SMA model, which identifies UZFWM, LZTWM, LZFSM, LZFPM, and ADIMP as the key parameters controlling runoff generation. These results guide a systematic calibration process using the Harmony Search (HS) metaheuristic algorithm, selected for its stable convergence behavior compared with other optimization methods. The calibrated model achieves a Nash–Sutcliffe Efficiency of around 0.7, demonstrating reliable streamflow reproduction in a data-scarce mountainous basin.

The lecture further introduces a newly developed reservoir operation module that is fully integrated into the SAC-SMA modeling workflow. This module simulates reservoir storage dynamics, release rules, and regulated downstream flows. Validation using major flood events in 2023 and 2024 shows that the coupled model accurately captures reservoir water levels and peak discharges, with peak flow errors between 11 % and 38 % depending on the event. The results highlight how the integration of sensitivity analysis, optimization, and reservoir operation modeling provides a robust and computationally efficient tool for hydrological forecasting and water resource management. The lecture concludes by discussing the potential for extending this open-source framework to other basins in Vietnam and Southeast Asia.



Thi Thuy Ngo got Bachelor degree in 2008 from Hanoi Water Resources University (Thuyloi University). In 2009, Thi Thuy Ngo achieved a master scholarship from DAAD for TERMA-VN program in Hanoi, Vietnam and got Master's degree in Water Resources Management. In 2017, she received Ph.D. in Civil, Environmental and Architectural Engineering from Korea University with the topic in Urban drainage system and Optimization.

Currently, Thi Thuy Ngo is a Senior Researcher and Deputy Director of Hydrology and Oceanography Research Center in The Viet Nam Institute of Meteorology Hydrology and Climate Change, Hanoi, Vietnam. Her research interests are in flood forecasting, hydrological and hydraulic modeling, flood risk assessment and AI application in hydrology and water resources.

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