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WEBINAR

An update in recent research and engineering practice in deep excavations and shield tunneling

22nd July 2026

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THE SPEAKERS

Professor Bin-Chen Benson Hsiung



Mr. Hesbon Moriasi Okari



Dr. Ari Surya Abdi



Mr. Muhammad Dwiyanto Agung Prakasa



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SPEAKER BIODATA AND SEMINAR SYNOPSIS



Professor Bin-Chen Benson Hsiung

National Chung Hsing University, Taichung, Taiwan

Professor Bin-Chen Benson Hsiung received his PhD from the University of Bristol, UK, and subsequently worked in London on several large-scale infrastructure projects in both the UK and Taiwan. He returned to Taiwan in August 2003 to join academia, where his primary research interests remain focused on deep excavations and soft-ground tunneling.

In parallel with his academic work, he is actively involved in underground engineering and offshore wind projects as a technical consultant and advisor. Projects are widely located in South Asia, Southeast Asia, and Taiwan.

Professor Hsiung is a well-qualified Chartered Civil Engineer in the UK and Registered Professional Geotechnical Engineer in Taiwan. He currently serves as Chair of AsRTC6 and as a member of TC204 and TC305 of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE) also international secretary of the Chinese Taipei (Taiwan) Geotechnical Society. He is presently with the Department of Civil Engineering at National Chung Hsing University, Taichung, Taiwan, as a full professor.

Geotechnical Concern & Challenges for Deep Excavation and Tunneling In Urban Areas

This study first explores various case histories of deep excavation & tunneling around Europe, South Asia, and Southeast Asia and some experience-sharing is presented. Moreover, it identifies several distinctive characteristics of deep excavations and tunneling in Taiwan, including construction in highly challenging ground conditions such as very soft clay and comparatively large gravel, pebble, and boulder deposits. The associated geotechnical risks and corresponding protection measures are examined and discussed, and the effectiveness of these measures is also reviewed. In addition, updated codes and environmental constraints are presented.

The overall performance of deep excavations and tunneling projects in Taiwan is evaluated through observations of lateral wall displacement, ground settlement, groundwater level, pore pressure, and strut load. Among these performance indicators, the maximum wall displacement (d_{hm}) is generally regarded as a critical index in engineering practice. Consequently, the focus of this study is placed on this matter.

Typically, two-dimensional or beam-spring model analyses are employed for prediction; however, these approaches may overestimate d_{hm} when corner effects are significant. To address this issue, a factor termed the Plane Strain Ratio (PSR) is introduced, which incorporates the influence of corner effects into the prediction of d_{hm}. Finally, for excavations in sandy soils, a predictive model is developed using regression analysis. This model relates d_{hm} to the safety factor, stiffness of the retaining wall and strutting system, and equivalent ground stiffness, providing a practical tool for forecasting maximum wall displacement.



Mr. Hesbon Moriasi Okari

National Chung Hsing University, Taichung, Taiwan

Eng. Okari earned his BS and MS in Civil Engineering from the University of Nairobi and National Taiwan University of Science and Technology respectively. He is a PhD candidate at National Chung Hsing University. He is a lecturer at the University of Nairobi and a practicing geotechnical engineer in Kenya. He is the vice president of the Tunneling Association of Kenya. He has been involved in design and construction of tunneling projects in Kenya among them the 12km Itare bulk water transfer tunnel.

Estimation of cutter tool wear performance in shield tunneling using numerical simulation and machine learning

Cutter wear remains a hindrance to safe, efficient, and cost-effective shield tunneling, particularly in relatively stiff ground conditions. The machine-ground interaction, as reflected in the evolution of operating parameters, can provide useful indirect information on the development of cutter wear. In the face of scarce wear monitoring data, unsupervised machine learning (ML) can identify underlying operational and wear-related patterns.

The interaction is analyzed as an energy conversion system. Energy indicators associated with cutter wear can be estimated through energy analysis of numerical models to interpret machine-learned patterns from monitoring data. Using a shield tunneling case for a water transfer project in Central Taiwan, Distinct Element Modelling is applied to approximate the mechanics of cutter-ground interaction. These approaches can support physics-informed ML-based cutter wear prediction and improve understanding of cutter wear performance.

SPEAKER BIODATA AND SEMINAR SYNOPSIS

Dr. Ari Surya Abdi National Taiwan University, Taipei, Taiwan



Dr. Ari Surya Abdi is a Postdoctoral Fellow at National Taiwan University, Taiwan. He received his PhD and MSc degrees in Civil and Construction Engineering from National Taiwan University of Science and Technology, and his BSc degree from the University of Lambung Mangkurat, Indonesia. His research mainly focuses on geotechnical data analysis, Bayesian machine learning, uncertainty quantification, and excavation performance prediction. He has worked on hierarchical Bayesian modelling, physics-informed and data-driven approaches, and numerical modelling for deep excavation problems.

His current research aims to develop reliable and practical predictive frameworks for underground construction using field monitoring data, probabilistic learning, and advanced geotechnical modelling.

Prediction of Excavation Performance in Clays Using Hierarchical Bayesian Model-Based Stacking Ensemble Learning Framework

Deep excavation databases are often sparse, site-specific, and contain missing or extrapolated data. This presentation introduces a Hierarchical Bayesian Model-based Stacking Ensemble Learning Framework (HBM-based SELF) for predicting wall deflection and ground settlement in deep excavations. The framework integrates twelve Bayesian model variants with different levels of complexity and selects the most suitable model using the least predictive entropy criterion, allowing it to address site-specific behavior and extrapolation problems. The model is trained using a database of 332 excavation sites from 20 countries, validated using the Formosa excavation case in Taipei, and further evaluated through extensive cross-validation. The results show that the proposed framework can improve prediction accuracy, reduce uncertainty, and provide more reliable stage-wise predictions compared with single Bayesian models and conventional regression approaches.



Mr. Muhammad Dwiyanto Agung Prakasa State Polytechnic of Ujung Pandang, Makassar, Indonesia

Mr. Muhammad Dwiyanto Agung Prakasa completed his bachelor's degree in civil engineering from Institut Teknologi Sepuluh Nopember (ITS), Surabaya, Indonesia, in 2017, followed by a dual master's degree in geotechnical engineering from ITS and National Taiwan University of Science and Technology (NTUST), Taipei, Taiwan, in 2019. He is currently a lecturer at the State Polytechnic of Ujung Pandang, Makassar, Indonesia. His research areas mainly focus on numerical modeling and soil-structure interaction. In addition, he has also been involved in several geotechnical engineering projects in Indonesia.

Wall Deformation Induced by Deep Excavations in Urban Areas: Numerical Study on Time-Dependent Behavior and Innovative Support Systems

In urban areas, wall deformation induced by excavation is one of the critical aspects that may affect the adjacent structures if the magnitude exceeds the tolerable value. In top-down construction, it is found that time-dependent soil behavior, including creep and consolidation effects, could increase the total wall deflection. It is therefore critical to carefully select appropriate support systems, including ground improvement techniques if needed, including jet-grouted slab and buttress wall in a strut-free excavation system. Thus, comprehensive finite element modeling is used to examine these case studies from Indonesia and Taiwan to provide a better understanding of wall deformation mechanisms and to offer practical guidance for geotechnical engineers in designing safer and more efficient deep excavations in urban environments.

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