Geotechnical Engineering Journal of the SEAGS & AGSSEA Vol. 47 No.1 March 2016 ISSN 0046-5828

ENGINEERING

Journal of the

SOUTHEAST ASIAN GEOTECHNICAL SOCIETY

&

ASSOCIATION OF GEOTECHNICAL SOCIETIES IN SOUTHEAST ASIA

AGSSEA

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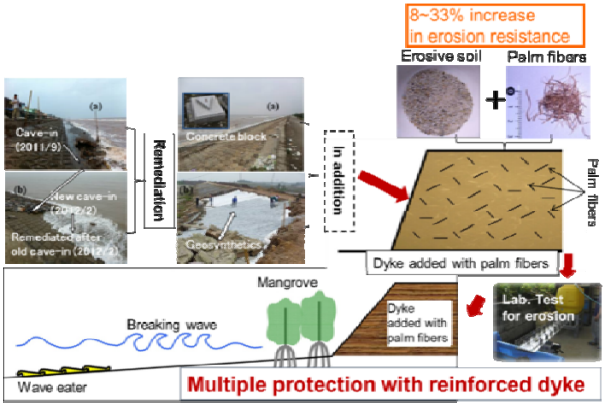
Editors: Dr. Phung Duc Long & Prof. San-Shyan Lin

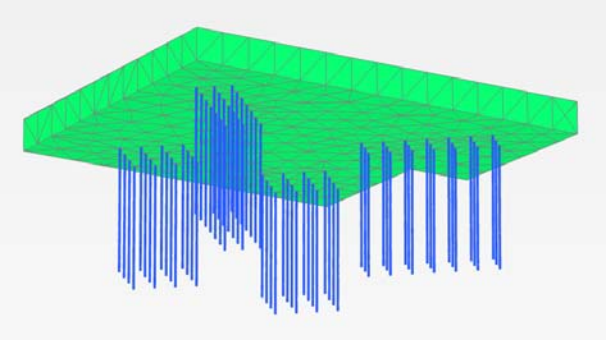


Multiple protective measures used in coastal areas

(After Yasuhara *et al.*, 2016)

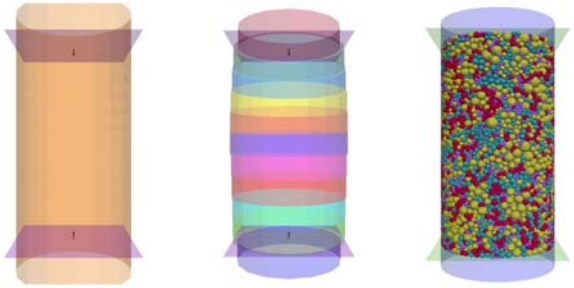
Example of erosional scene of river bank in the Mekong Delta

(After Yasuhara *et al.*, 2016)



Plaxis 3D piled raft foundation model

(After Phung Duc Long, 2016)



Geometry of DEM models

(After Nguyen Quang Tuan and H. Konietzky, 2016)

GEOTECHNICAL ENGINEERING

March-2016 Issue: Vietnam Special Issue
Edited by Dr. Phung Duc Long & Prof. San Shyan Lin

Dr. Phung Duc Long

Dr. Phung is President of the Vietnamese Society for Soil Mechanics and Geotechnical Engineering (VSSMGE). He received his Ph.D. degree at the Geotechnical Department, Chalmers University of Technology in Gothenburg, Sweden in 1993. He has worked at the Institute for Building Science & Technology (IBST) in Hanoi, Vietnam from 1975 to 1988; at the Swedish Geotechnical Institute (SGI) in Linköping, Sweden from 1988 to 1994; at Chalmers University of Technology from 1989 to 1993, at Skanska Sweden as Technical Manager from 1994 to 2002; at WSP Asia in Hong Kong as Associate Director from 2002-2003; at WSP Vietnam in Hanoi as General Director from 2003-2011; and at Long GeoDesign as Director since 2011.

Dr. Phung has 40 years of international experience. His expertise areas are: deep foundations and piled raft foundations for high-rise buildings, temporary and permanent support for deep excavations, tunneling, soil improvement, underpinning, pile dynamics, and numerical analysis of soil-structure interaction problems. He has worked with projects in many countries, as Sweden, Norway, Denmark, USA, England, Russia, Germany, India, Hong Kong, China and Vietnam, etc. Some of his highlight projects are: Uni-Storebrand Headquarter in Oslo with steel-core piles into rock; SL-10 South Link in Stockholm with sheet pile wall for deep cut & cover tunnel in soft clay; Fredriksberg Metro Station in Copenhagen, the world largest drilled-pile wall for deep excavation; soil stabilization with lime-cement columns for Highway I15, Salt Lake City, Utah, USA; Öresund Link between Sweden and Denmark; Årsta Bridge in Stockholm with pile foundations and sheet pile walls in deep water and soft clay; the peer-review of piled foundation for the ICC Tower, 118 floors, 490m high in Hong Kong, the No. 4 tallest high-rise in the world, and the Sailing Tower in Ho Chi Minh City, Vietnam. He is the author and co-author of more than 100 technical papers and books in English, Swedish and Vietnamese for different national, regional and international seminars, conferences, and technical journals. He is the chief editor of a number of publications, as the proceeding of the international conferences Geotec Hanoi 2011, and Geotec Hanoi 2013.

Prof. San-Shyan Lin

Dr. Lin is a Professor at Department of Harbor and River Engineering of National Taiwan Ocean University in Taiwan. He received his Ph.D. degree in Civil Engineering from Washington University in St. Louis, Missouri USA in 1992. Dr. Lin was an engineer at Taiwan Area National Expressway Engineering Bureau from 1992 to 1994. Prof. Lin also served as TRB A2K03 Committee member on Foundations of Bridges and Other Structures between 1995 and 2004. He is also serving as committee member of TC-212 and ATC-1 of ISSMGE and as editorial board member of four major international journals in geotechnical engineering.

Prof. Lin's research and practical experiences have been dealt with static and dynamic behaviour of deep foundations, ground improvement and effects of scouring on bridge foundations. In the past decades, he was involved in many research projects such as interpretation of pile load testing results due to axial, lateral, or combined loading; effect of soil liquefaction on performance of pile foundation in sand; seismic effect of pile foundations; performance of suction pile in sand or in clay; and effect of scouring on performance of pile and caisson foundations etc. Prof. Lin has published more than 110 peer-reviewed journal papers and conference papers. One of his published Journal papers dealing with cyclic lateral loading effect on permanent strain of deep foundation due to cyclic lateral loading has been cited more than 60 times in Google academic website by many international researchers working on wind turbine foundations.

GEOTECHNICAL ENGINEERING

PREFACE

This journal issue was edited and contributed from works in Vietnam by Vietnamese authors and other popular persons.Sixteen papers are contained in this issue. Dr. Phung Duc Long is the lead editor. His Vietnamese team included: Dr. Pham Van Long, Dr. Pham Huy Giao, Mr. Mai Trieu Quang, Dr. Nguyen Anh Minh, Dr. Vu Quang Hung, and Dr. Vu The Manh.

The construction field in Vietnam has been under a very fast development. More than ten years ago the first 30-storey tower appeared in Vietnam. Today, the height has reached to 70-80 floors. During the last decade many tall towers, long bridges, deep tunnels, large hydro-power dams, large airport and habours, etc have appeared in Vietnam. Thousands of kilometers of highway have been constructed. New metro projects have been started both in Hanoi anh Ho Chi Minh City. It is understandable why geotechnical engineering has recently developed very fast in Vietnam.

The issue's major topics relate to piled raft foundations; piled foundations for storage tanks; pile group settlements; coastal and riverine erosion in the context of climate change; soil characterization for land subsidence evaluation for MRT projects; discrete modelling of excavation in fractured rock; settlement management for urban tunnels; evaluation of performance of diaphragm walls; study on clayey soils using piezocone; DEM simulations of medium dense sand in triaxial apparatus; characteristic of unsaturated soil of earth fill dams; ground improvement using soil-cement columns/deep mixing method; and ground improvement with preloading, and PVD and vacuum pressure.

Phung Duc Long (paper No.1) has made a detailed study on pile raft foundation in which the piles are used for reducing settlement, not for taking the total load from superstructure as in the conventional pile foundations. The results from his field model test, which strongly supports the concept of settlement-reducers, are reviewed. Basing on the experiment, a simplified design method is proposed. In the paper, the method is used for the conceptual design of a large high-rise building complex. In combination with FEM, the simplified method gives a reliable tool for conceptual design of piled-raft foundations. PLAXIS 3D is used for modelling both the piled and un-piled foundations in the study.

Yasuhara *et al*, (paper No.2) describe climate change related disasters such as erosion along riverine and coastal areas of the Mekong Delta in the South Vietnam. Also, the red river delta in the north is expected to be exacerbated by land subsidence, sea-level rise (SLR), and magnified typhoons. Adaptation to severe erosion is expected to respond to regional circumstances and the demands of local residents. Based on the expectations outlined above, for soft adaptation, attempts were made to conduct perception surveys of local residents, in addition to field surveys of erosion at riverside and coastal areas using an un-crewed aerial vehicle (UAV). Furthermore, for hard adaptation, a proposal is made to conduct pilot field tests at the coast for reinforcing coastal dykes using the combined technique of locally available materials with cost-saving eco-geosynthetics in addition to application of ICT. This paper explains the possibility of

smart adaptation combining soft and hard adaptation to reduce severe coastal and riverine erosion in the Vietnamese deltas.

Nguyen, H. M., Fellenius, B.H., Puppala, A.J. Aravind, P., and Tran, Q.T. (paper No.3) introduce bidirectional static loading tests on two shaft-grouted barrette piles of the 40-storey Exim Bank Building in Ho Chi Minh City, Vietnam. Simulation of the measured load-movement response indicated that the shaft resistance response was hyperbolic. The test schedule was interrupted by unloading/reloading cycles, which disturbed the gage data and included uneven load-holding durations which exacerbated the analysis difficulty.

Pham Huy Giao and Ta Thi Thoang (paper No.4) have an excellent paper on soil characterization and land subsidence prediction for the first MRT line in HCM city to meet the transportation needs of a fast growing population and rapid urbanization. Being located in the Sai Gon-Dong Nai delta HCM city area has low elevations and is underlain by a sequence of clayey, silty and sandy soil layers. Land subsidence due to groundwater extraction had been suspected and observed in HCM city. In this study, geotechnical characterization of the subsoil along the first MRT line was carried out. Prediction of land subsidence along this MRT line was conducted using a FEM consolidation code.

Shiwakoti and Manai (paper No.5) examine the application of deep cement-mixing technique in improving engineering properties of soft grounds at nine different sites in southern Vietnam's typical soft soil deposits. The exercise consisted of running a series of laboratory tests on undisturbed soil samples and their mixes with cement and field trials, followed by field application of 500,000 m cement treated columns with 600mm diameter, using Dry Jet Mixing technique. After the field trials and applications, cores were extracted from the treated grounds to evaluate improvement in their engineering characteristics. Both the laboratory and the field results revealed a drastic enhancement in strength, stiffness, and permeability of the treated soft soils.

Over-consolidation ratio (OCR) is an important geotechnical parameter for predicting undrained shear strength, lateral pressure ratio and settlement of clayey ground. Piezocone studies were made by **Bui Truong Son, Le Hong Quang and Lam Ngoc Qui** (paper No.6). In Southern Vietnam, a thick layer of saturated soft clays distributes throughout all the area. It includes Mekong (in Ca Mau province) and Dong Nai (in HCMC and Vung Tau) alluvial deposits. Below the soft clayey layer, there is a layer of either stiff to very stiff clay or fine sand. Based on the reliable data of consolidation test results of samples taken by piston tube and piezocone, relationship between over-consolidation ratio and normalized penetration resistant is established and analysed.

Phan To Anh Vu (paper No.7) studied the ground improvement using soil-cement method: A case study with laboratory testing and in-situ verification for a Highway project in Southern Vietnam. This article presents the experimental unconfined compressive strength results of soil-cement columns to improve the soft soil gained by Tan Son Nhat-Binh Loi Outer Ring Road Project, located in Ho Chi Minh City, Vietnam. The laboratory test results revealed that the Stable Soil cement has a greater unconfined compressive strength than tower (60%) slag cement. In addition, cement-soil samples obtained from in-situ indicated that the target cement content of 240 kg/m3 was satisfied not only a required compressive

strength (>24 kgf/cm2) but also a low-cost. The obtained results are expected to provide an experience for further design and construction in Ho Chi Minh City and its vicinity.

Bengt Fellenius and Mauricio Ochoa (paper No.8) write on the use of piled foundations for wide storage tanks. The authors have analyzed five case records involving wide piled foundations and show that the foundation settlement can be modeled as a flexible raft placed at the pile toe level with the foundation load distributed according to Boussinesq stress distribution and that the capacity of an individual pile is not relevant to the foundation performance. Differential settlement between the perimeter and interior piles and the effect of drag force and downdrag are discussed. The limitation of drag force as affected by the pile spacing and the weight of the soil in between the interior piles is addressed.

Tran Thi Thu Hang and Frederic Dubois (paper No.9) deal with discrete modelling of excavation in fractured rock by NSCD method. The presence of the network of discontinuities on intact rock is a special feature of nature rock masses. Non Smooth Contact Dynamics method (NSCD) is a discrete numerical method that owns many strong advantages of the study on granular materials and has been used recently in rock engineering. LMGC90, open-sourced software built on NSCD, has demonstrated a robust capacity in the modelling and mechanical analysis of diverse environments, masonry and rock included. In this study, a numerical modelling of a multi-phase-excavation in fractured rock was realized. The simulation of the tunnelling with the consideration of the state of the excavation and its neighbouring rock blocks, during and after the excavation schedule, and at each excavation phase was conducted. The obtained mechanical behaviours of the model were analysed, and three failure mechanisms of the excavation vicinity during the tunnelling was aimed. The observed phenomena showed typical effects of two components of the rock mass (rock structure and rock material) to the stability of the excavation and the host rock mass.

Duong Diep Thuy, Pham Quang Hung, and Le Thiet Trung (paper No.10) studied the pile groups in Vietnam using a method for estimating the pile group settlement considering the distribution of pile shaft friction, called SDF. For illustrating the proposed method is used for a full scaled experimental model by Koizumi et al (1967), for a field model test by Phung (1993) and for two case histories in Vietnam, Ca Mau Fertilizer Plant, and Ecopark Tower 2. Comparison of the calculated settlements with the measurement results shows that the SDF method provided a good prediction for all the studied cases.

Nguyen Quang Tuan and H. Konietzky (paper No.11) deals with the mechanical behaviour of Hai Duong Medium dense sand in triaxial test and its simulation using DEM. Numerical simulations of the drained triaxial behaviour of medium sand, a typical constructional soil material and widely used in Northern Provinces of Vietnam, were performed using discrete element method (DEM). The sand was simulated based on spherical particles using PFC3D with a non-linear contact model including rolling resistance. The calibrated simulations show that the DEM model is able to capture the mechanical behaviour of sand. The effects of different microscopic parameters on the macroscopic behaviour of the sand were investigated.

Tran The Truyen, Nguyen Van Hung, and Tran N. Hoa (paper No.12) studied the influence of geometrical parameters of soil cement columns on the settlement of embankments on reinforced soft soil. Deep Mixing Method (DMM) is a widely used soft soil improvement method in the construction of road, port, and tunnel foundations, etc. Deep mixing of cement with soil and water, forming Soil Cement Columns (SCC) in situ, has been applied in many projects in Vietnam in recent years; it has proved many advantages compared with other applied methods in the site. At present, Vietnamese engineers are concerned with finding out recommendations for an optimal choice of SCC scheme. This paper analyzes the influence of main geometrical parameters of SCC including the length, the diameter, and the spacing on the behavior of reinforced soft soils in some construction projects in Vietnam. The results will be an important basis for recommendations on the choice of rational schemes of SCC for soft soil improvement in Vietnam.

Benson Hsiung, Dao Sy Dan and William Cheang (paper No.13) evaluated the performance of diaphragm walls by wall deflection paths for deep excavations in Central Hanoi. The objective of this paper is to evaluate the performance of diaphragm walls by wall deflection paths for deep excavations in Central Hanoi. PLAXIS 2D was used for 2D finite element analyses in this paper. A benchmark analysis was first conducted on the excavation to verify the validity of material models and their input parameters for predicting wall deflections. The reference envelopes of wall deflection paths were then delivered for various conditions of deep excavations in Central Hanoi. Considering the current prediction, up to 72 mm of the maximum lateral wall displacement was predicted for an excavation with a 21.9 m depth. Reference envelopes of excavations have been developed and discussed in various conditions of the excavation. It is found that the maximum lateral wall displacement at the first stage of excavation is roughly inversely proportional to the Young's moduli of soils. Changing the wall thickness leads to the limited difference in reference envelope at shallow excavation stages, but this may not be correct when the excavation goes deeper.

Hoang Hiep and Pham Huy Giao (paper No.14) studied the effect of vacuum pressure distribution on settlement analysis results for an improved thick soft clay deposit at Sai Gon-Hiep Phuoc terminal port, South of Vietnam. In this study an approach of settlement analysis using a FORTRAN code was proposed to successfully simulate the large consolidation settlement of a thick soft clay deposit, improved by combination of preloading, PVD and vacuum pressure for Sai Gon-Hiep Phuoc (SGHP) project. Geotechnical characterization of the subsoil profile underlying the project site was carefully done to provide input data for settlement analysis, in which a particular focus was given on studying the vacuum pressure distribution along the 35-m deep PVD. It was found that the coefficient of vacuum pressure distribution (kP) from 0.85 to 1.0 gave the best estimation of the time-dependent total primary settlement as embankment construction goes in addition to a smear effect RS= 3.0. The increasing trend of kP with time might be explained by the fact that for the later stages of loading the vacuum pressure could spread more to the depth.

Nguyen Thi Ngoc Huong and Trinh Minh Thu (paper No.15) studied the Characteristic of Unsaturated Soil of Earth Fill Dams in Vietnam. Earth dams in Vietnam, especially earth dams at the central part of Vietnam, are generally made using in-situ soils having low clay content. The knowledge, experience, calculation theory, apparatus etc, for unsaturated soils in Vietnam are still very limited, especially the

studies of the influences of the shear strength of unsaturated soils to the stability of earthen structures. Therefore, study on the soil-water characteristic curve, shear strength and coefficient of permeability versus different matric suction for Vietnamese soil is an urgent task. This study shows that when the matric suction in the soil changes, the effective cohesion c' would also change; however the internal friction angle is almost unchanged for some types of soil in Vietnam. The experimental results can be applied to study the effect of unsaturated soil to the factor of safety of the slope.

Finally paper by **Alain Guilloux and Hervé Le Bissonnais** (paper No.16) is on the management of settlements for urban tunnels. The TOULON highway tunnel is located in a very dense urban environment, and a much complex geology. The excavated section is about 120 m^2 and the depth is in the range 15-35 m. The aim of the paper is to show how a great attention was paid to the settlements control: at the design stage through soils investigations, survey of existing constructions in regards to their sensibility to tunnel induced settlement, definition of settlements thresholds, and choice of ground pre-reinforcement techniques; during the construction, by heavy monitoring of deformations and continuous adaptation of the supports to the actual settlements and buildings behaviour.

This issue contains sixteen papers which are related to the Vietnam soil conditions and contribute to the advancement of geotechnics, and are all written by the Vietnamese authors, about projects in Vietnam, or the topics that Vietnam are facing. It is hoped that the issue will demonstrate how the authors have made their studies geared in a manner useful to geotechnical engineers in Vietnam and elsewhere.

Phung Duc Long

ACKNOWLEDGEMENT

It is a genuine pleasure to note that this Issue contains sixteen excellent contributions as made by authors mostly from Vietnam in using modern developments in Geotechnics relevant and applicable to Vietnamese soil and rock conditions. They are mostly practical in nature and is an excellent example of how research be conducted useful to our geotechnical profession in practice. Dr. PHUNG Duc Long is the lead editor. His Vietnamese team included: Dr. Pham Van Long, Dr. Pham Huy Giao, Mr. Mai Trieu Quang, Dr. Nguyen Anh Minh, Dr. Vu Quang Hung, and Dr. Vu The Manh.

The Preface by Dr. Phung adequately covers the details of the contributions by the authors. Vietnam is an important arm of our AGSSEA and has developed enormously in the recent years with tall buildings, coastal structures, highways and expressways, airport developments etc. It is a paradise for geotechnical engineers. We are all most grateful to Dr. Phung and his team. This issue demonstrates the future of Geotechnics extend to all member countries of AGSSEA and beyond. The successful conferences and symposia organised by the Vietnamese Society for Soil Mechanics and Geotechnical Engineering (VSSMGE) is also worthy of praise.

K. Y. Yong

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Geotechnical Engineering Journal of the SEAGS & AGSSEA Vol. 47 No.1 March 2016 ISSN 0046-5828

GEOTECHNICAL ENGINEERING

March 2016: VIETNAM SPECIAL ISSUE

Editors: Dr. Phung Duc Long & San Shyan Lin

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GEOTECHNICAL

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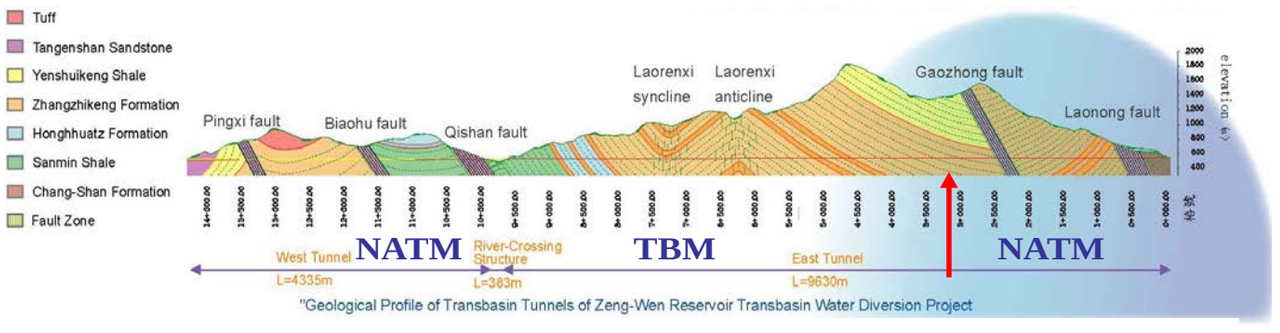

Geological profile along tunnels in TDT project

(After Lee, Wang, Chang, Lien and Huang, 2016)

GEOTECHNICAL ENGINEERING

JUNE 2016 ISSUE: CTGS ISSUE

Edited by Meei-Ling Lin

Professor Meei-Ling Lin

Dr. Lin is a Professor at Department of Civil Engineering, National Taiwan University. She received her Ph.D. degree in Civil Engineering from University of Texas, Austin, USA, in 1987. Dr. Lin has been a member of the General Committee of the Southeast Asia Geotechnical Society since 2007. She serves as a committee member of the Jointed Technical Committee 1 (JTC1 on Landslide) of the International Society for Soil Mechanics and Geotechnical Engineering, the International Association for Engineering Geology and the Environment, the International Society for Rock Mechanics, and the International Geo-textile Society. She also serves as a committee member of Technical Committee 303 (TC-303 on Flood) and Asian Technical Committee-1 (ATC-1 on Climate Change) of ISSMGE.

Prof. Lin's research interests and experiences include: potential analysis and simulation and behaviors of debris flow and slope stability, seismic slope behavior and stability, dynamic soil behaviors associated with soil liquefaction and ground responses analysis, mapping and micro-zonation of related debris flow, seismic slope stability potential, and seismic ground response. She lead a group to initiate a drafted Code for the Engineered Slope for the Ministry of Transportation and Communication, Executive Yuan, Taiwan. She has been invited as a Keynote speaker of international conferences, a special lecture speaker of International Landslide Symposiums and a panel reporter by ISSMG Conferences, and recently delivered an Opening Keynote for the Fourth Italian Workshop on Landslides.

SPECIAL FEATURE STORY ON

"Recent Diaphragm Wall Technologies and Future Challenges"
By Hosoi Takeshi and Matsushita Shinya.

Dr. Hosoi Takeshi

Dr. Hosoi Takeshi is a Technical Advisor at WSP Parsons Brinckerhoff, Singapore. He received his PhD with research focused on "Bearing Capacity of Diaphragm Wall Foundation and various Issues during its Construction" from Kyoto University, Kyoto, Japan in the year 1993.

Dr. Hosoi has more than 50 years of experience in design and construction of underground structures, tunnelling, bridge foundations and marine works. He is an international expert in diaphragm wall, barrette and bored pile foundation, shield tunnelling, NATM tunnelling, and other complex geotechnical works.

He is a Professional Engineer (PE) in Japan Since 1983, Fellowship of Japanese Society of Civil Engineer and International Member of Japanese Geotechnical Society. He coordinated the Asian Ocean Seminar sponsored by Japanese Ministry of Port and Harbour for 10 years. He was also a national member in "E-Defence Project" in Japan.

He served as a General Manager of Technical Research & Earthquake Technology Research Institute for 8 years and General Manager of Design Department of Nishimatsu Construction Co. Ltd. for 7 years.

Mr. Matsushita Shinya

Mr. Matsushita Shinya has been a Chief Engineer of Matsushita M&C Lab Co. Ltd. Since 2013. He was graduated from Nagoya University (Department of Science) in 1972 and joined Matsushita M&C Lab Co. Ltd.in 1972. He served as CEO of Matsushita M&C Lab. Co. Ltd. from 2003-2013. He is a Member of Japanese Geotechnical Society. He has been involved in a lot of big diaphragm wall projects in Japan for more than 40yers. In 1982 he was engaged in the experimental diaphragm wall construction for practical use of high DS polymer slurry and in 1984 he was joined the diaphragm wall construction project for Nagoya Subway 6 Line to lead successful adoption of polymer slurry. He was involved in Diaphragm Wall Foundation of Aomori Bay Bridge in 1988 and also in 1991 Diaphragm Wall Shaft at Kawasaki Artificial Island for Trans Tokyo Bay Highway Road. From 1992 to 1994 he was invited by the Grand Hi-Lai Hotel project and the Tuntex project（the Tuntex & Chien Tai Tower）at Kaohsiung, Taiwan as a consultant of Polymer slurry. From 2001 to 2006 he took part in the Water

Cut-off Wall Project at Kansai International Airport for stabilizing land settlement as a chief engineer for quality control of slurry. In 2008 he engaged in the Wall Foundation , “Knuckle Wall ” Project of Tokyo Sky Tree as a chief engineer for quality control of polymer slurry.

HISTORICAL NOTE ON

"Expriences of Geotechnical Development in Japan and Future Directions"

By Masami Fukuoka

Professor Masami Fukuoka

Prof. Fukuoka was born on 12 March 1917 in Okayama Prefecture, Japan. He studied Civil Engineering at the University of Tokyo, and in 1940 he entered the profession fully, taking up a post as a civil engineer for Japan's Public Works Research Institute (PWRI) of the Ministry of Internal Affair. During the Second World War, he served in the Japanese military.

He returned to PWRI after the war ended, and his engineering acumen was immediately needed. Japan experienced a series of severe earthquakes and floods, which further complicated the damage the country had suffered to its infrastructure during the war. It was one of the most difficult times in the history of Japan, he said to me when I was young. As a civil engineer, in particularly, as a geotechnical engineer, he worked to restore Japan's infrastructures from the effects of war and natural disasters. His strength of leadership was an especially important contribution to the design and construction of a great number of important infrastructures; and his work improved projects across a broad range of sectors, including those dealing landslides, road building and pavements, slope stability, flood control, river and coastal dyke engineering, ground investigation and soil test, earth pressure and retaining walls, rock-fill and earth-fill dams, ground subsidence, foundations of long-span bridges, earthquake geotechnical engineering and, eventually, geosynthetic engineering. The breadth of his work was extraordinary, considering how difficult it is to become a specialist in even one of these areas today. After rising to serve as PWRI's director, he retired in 1970 and entered academia and became a full professor of Civil Engineering of the University of Tokyo, where I was studying as doctoral candidate. In 1977, Prof. Fukuoka transitioned to a professorship

at Tokyo University of Science where he remained until his retirement in 1986. As his career progressed; he contributed greatly to multiple professional organizations. He helped establish the Japanese Geotechnical Society (JGS) in 1949 and served as President from 1976 – 1997. He was integral to Tokyo playing host to the 9thInternational Conference on Soil Mechanics and Foundation Engineering, then served as President of the International Society for Soil Mechanics and Foundation Engineering (now ISSMGE) from 1977-1981.During this period, while at Tokyo University of Science, he started the research on geosynthetic-reinforced soil retaining walls and geomembrane lining at the bottom of reservoirs.

GEOTECHNICAL ENGINEERING

PREFACE

This Issue contains thirteen excellent papers as the country issue from Chinese Taipei Geotechnical Society (CTGS). It is an example of contributions from leading private sectors in Taiwan and also academics.

The first paper by Lee et al deals with the topic of rock tunnelling applied to steady water resources supply in Taiwan, challenges and examples. The authors deal with increasing soil erosion and slope collapse in some catchment area in Taiwan in the past decade. Also, increased sedimentation rates of the reservoirs reducing the effective capacity, and severely affecting the steady water supply. Multiple measures have been proposed for stabilizing the water supply. Tunnelling in the catchment area, even close to a dam, represents serious environmental and engineering risks. The authors present two cases of rock tunnelling as applied to steady water resources supply. Challenges and some distinctive issues, such as the presence of a high-temperature ground, a combustible gas emission ground, and potential instability of rock wedges caused by large underground excavation, are discussed. The authors then present countermeasures with a clever design of an elephant-trunk intake pipe to release turbid water. State-of-the-art tunnelling through rock and some innovative tunnelling technologies are utilized in these two cases.

The second paper by Chiu et al deals with the interesting topic of the state-of-the-art of tunnel maintenance in Taiwan and challenges to sustainable development. Tunnel construction in Taiwan started as early as the late nineteenth century; within the last 125 years, tunnel maintenance in Taiwan went through several stages. In early years engineers dealt with tunnel excavation. Now tunnel inspections, repairs and reinforcement were performed only when serious damages were observed. As the number of damaged tunnels increased, investigations revealed that the degradation of tunnels in Taiwan is inevitable and usually occurred in an exceptionally shot period. Frequent earthquakes, a high ground water level and poorly cemented rock masses provide an environment for such degradation. To adapt more effectively to the environment, tunnel maintenance looked at the entire life cycle of a tunnel. Thus the diagnostic methods have demonstrated to be useful in enhancing the sustainable operation of tunnels.

An interesting contribution by Wang et al dealt with rock tunnel –shaft intersection in projects in Taiwan. The construction of an intersection between a shaft and a rock tunnel is a three-dimensional problem, and requires more complex excavation and support methods than those used in conventional two-dimensional tunnel construction. The paper considered examples of rock tunnelling in Taiwan, and the construction of intersections between shafts and tunnels. Data are collected from case histories first, and the excavation sequences are classified. Then challenges as encountered to secure construction of the intersections of shafts and tunnels are examined, including the significant scale effects of rock masses on excavations; difficulties

in controlling rock deformation near the intersections, and groundwater ingress are also discussed. Strategies and countermeasures as applied to overcome these difficulties in recent projects, and their effectiveness is investigated. Finally, the state-of-the-art design and construction of intersections between shafts and tunnels in Taiwan are presented.

The fourth paper by Hsiao et al dealt with the influence of peak strength degradation in assessing the stability of tunnels in hard rocks. Tunnelling depths are increasing rapidly in Taiwan. The effect of brittle failure on hard rock tunnelling is, however, rarely studied. In this paper, a study is carried out on the importance of the post-peak behaviour using Hoek-Brown failure criterion is investigated; through strength loss experimental studies , a relationship between strength loss parameter and confining stress is established. Subsequently, a numerical analysis model (so-called strength degradation model), is proposed and applied to predict the impact of the post-peak strength degradation on an actual tunnel. The analysis showed that the effect of the post-peak strength degradation on deformation during excavation is becoming more and more pronounced with increasing depth of tunnels. Severe deformation due to the excavation may endanger the tunnel stability during construction in deep overburden. Thus the strength degradation beyond brittle failure shall play an exceptionally important role in the stability of deep tunnelling.

The fifth paper by Hwang et al is on the deep excavations in Taipei Basin and the performance of diaphragm walls. Since movements of diaphragm walls are reduced by the presence of existing underground structures in the vicinity of excavation, comparison of the observed wall deflections with the results obtained by using two-dimensional analyses may lead to erroneous conclusions. Similarly, additions to diaphragm walls, such as buttresses, station entrances, ventilation shafts, etc., will also tend to reduce wall deflections. Thus the authors recommend to compare the results of two-dimensional analyses with the upper envelopes, designated as “reference envelope”, of a family of wall deflection paths of the same geometry of excavation and the same characteristics of the retaining system. Inclinometer readings obtained at Shandao Temple Station of the Bannan Line of Taipei Metro were studied to establish the relationship between wall deflections and depth of excavations. The results are verified by numerical analyses using PLAXIS computer software. Reference envelopes were then developed for estimating maximum wall deflections; and charts were established for correcting inclinometer readings to account for the movement at diaphragm wall toes. The authors found that the width of excavation has significant influence on wall deflections and toe movements. Additionally, the consolidation of the Songshan Formation due to the drawdown of groundwater in the Jingmei Formation reduced the movements of diaphragm wall toes.

In an interesting paper Yang et al studied the hydraulic characteristics of the Jingmei Formation and the Dewatering of Deep Excavations in Taipei Basin. Geotechnical Engineers in Taipei are well aware that the Jingmei Formation is a unique geological feature of the Taipei Basin. It is highly permeable and a water-rich stratum responsible for many failures in underground constructions. The piezometric heads in the

Jingmei Formation had to be lowered by pumping for the deep excavations to be carried out safely. The authors thus discuss the hydraulic characteristics of the Jingmei Formation and the experience gained in large scale dewatering schemes. Attempts have been made to establish the relationship between the progression of tides in the river and the fluctuation of the piezometric levels in this Formation. The authors found that, the transmissivity and storage coefficient deduced from the observed groundwater drawdown are affected not only by the pumping rate, but also the duration of pumping; thus the rates required tend to be overestimated as based on the results of pumping tests.

Forensic studies have now become an important field in geotechnical engineering. The seventh paper by Lee et al is on the forensic investigation of a subway tunnel failure during construction. In this paper, the forensic evidences and investigation of a subway tunnel construction failure occurred in Kaohsiung, Taiwan is presented. The studied construction failure occurred during a cross-passage excavation of a shield tunnel construction work of the Kaohsiung Mass Rapid Transit System, and resulted in severe tunnel collapse and extensive ground failure that even reached to ground surface 30m above the tunnel depth. Valuable photo images obtained during and post event, as well as results of special geophysical testing methods were presented and compared to verify aspects of the proposed failure scenario. Information presented in this paper would be helpful to improve engineers' knowledge for preventing similar construction risks.

Typhoon Morakot brought tremendous rainfall of a hundred-year recurrence period in Taiwan. The paper by Chou et al concentrates on the effects as encountered by roads and houses in the middle and southern part of Taiwan; from landslides, debris flows, and floods. Erosion of road foundations, sliding of slopes, and collapse of bridges has paralysed the road system. Using Alishan Route 18 as an example, this paper discusses different causes, types, and renovation methods of slope disasters for future reference.

The paper by Lee et al also deals with the forecast of shallow landslides pertinent to Taiwan in a study which combines rainfall parameters and landslide susceptibility. Catastrophic landslides and debris slides triggered by typhoons such as Typhoon Morakot (2009) have occurred more frequently in the recent years, and caused many casualties and much economic loss in Taiwan. For the purpose of reducing the damage and preventing loss of life resulting from geological hazards, this study collects multiple period landslide inventories which contain the information of occurrence time, location, magnitude, rainfall intensity, and accumulated rainfall to establish the rainfall threshold for shallow landslides on a regional scale. The concept of a hazard matrix which combines the magnitude (landslide ratio of slope units) and the possibility of occurrence (historical disaster records) are investigated to set up the early warning thresholds. Accordingly, the critical rainfall thresholds were built up based on the R_{24} (24 hours cumulated rainfall) and I_3 (3-hour mean rainfall intensity) of historical records. The model developed can predict the possible sediment hazard on the hillslope 2~9 hours before occurrence of landslides. The web based GIS helped to have early-warning systems to display the real-time rainfall data and the warning signal immediately for disaster prevention through increasing the response time.

Chang et al made dynamic analyses for performance based seismic design of geotechnical structures with examples in deep foundation. Performance-Based Seismic design (PBSD) of geotechnical engineering structures can be evaluated by a number of methods taking into account the uncertainties of the designed influence factors. Despite the fact that the seismic force is known to be a significant factor, the static and/or pseudo static analyses seem to be commonly adopted in design practice. The paper by Chang et al briefly discusses alternate approaches with the emphasis on dynamic analysis. Examples are given with the assessments of two deep foundations located in Taiwan. Dynamic analysis is rather important to the seismic design problems since it can monitor the details of time-dependent structural responses incorporating both peak ground acceleration and duration of the earthquake. Other than the 3D finite element analysis, the simplified solution from 1D wave equation analysis can be very effective and convenient for PBSD analysis on deep foundation.

The eleventh paper in this CTGS Issue is on the time dependent dynamic characteristics during soil liquefaction in saturated sand. Chen et al, conducted model pile tests to quantify the relation between soil stiffness and excess pore water pressure during liquefaction, the test data of a series of shaking table tests on model pile in saturated sand using a large biaxial laminar shear box conducted at the National Center for Research on Earthquake Engineering were analysed. The pile tip was fixed at the bottom of the shear box to simulate the condition of a pile foundation embedded in a firm stratum. The pile head was mounted with steel disks to simulate the superstructure. In addition, strain gauges and mini-accelerometers were placed on the pile surface to obtain the response of the pile under shaking. Therefore, the model pile can be considered as a sensor to evaluate the changes of dynamic characteristics of soil-pile system during the shaking by using the time-frequency analysis and system identification technique. The results showed that the stiffness of the soil would increase with the dissipation of pore water pressure and the recovery of soil stiffness is directly related to the effective stress ratio of soil specimen.

The interesting paper by Shi et al present geological investigation and sliding mitigation in Jiufen Area in Taiwan. Jiufen's orographic and geological characteristics together with frequent typhoons and heavy rain make it potentially vulnerable to landslides. The landslide problems can be disastrous not only to the 2,300 local residents, but also to the constant flow of tourists visiting the town. After the site investigations, it is concluded that both of the colluvium and groundwater are the most important geological factors to the slope stability problems. According to the long-term groundwater level monitoring result, it varied from 8m to 12m during the period of typhoon and heavy rainfall. And the displacement induced by the groundwater level rising was found. Four underground flow lines were located based on the resistivity image profiling and self-potential investigation. Then five water collection wells were planned to construct according to the locations of underground flow lines. The level lowered down about 15m after the wells completed and the slope became stable. It is suggested that the depth of colluvium in Jiufen area needs to be investigated in more detail.

Finally the last paper thirteenth in this Issue is by Shu et al on the interpretation and analysis of potential fluidised landslide slope. Fluidized landslide, also called hillslope-type debris flow, often occurs on the village side hillslope in the mountain area during extreme weather condition. Fluidized landslide induces more severe damages than the shallow landslide; however its recognition model is still lacked. In this research a recognition model of the potential fluidized landslide slope was developed using 80 cases occurred in the Kaoping River basin, southern Taiwan. 30 fluidized landslides and 30 shallow landslides are employed for the model development and another 10 events of each landslide are applied for verification. Results show that the recognition model composed of 8 discriminant factors including geomorphology factors, hydrology factors and potential landslide factor predicated by SHALSTAB model provides accuracy rate of 85% of the verification events. Thus the model can be of practical use for fluidized landslide interpretation. The model can be used to identify the potential dangerous slope areas and effectively assist the disaster prevention and early warning of villages in mountain area.

The editor of this CTGS Issue is very pleased to be able to present the geotechnical activities in Taiwan through these thirteen contributions and hope that the material would be beneficial to Geotechnical Engineers in SE Asia and elsewhere.

Meei Ling Lin

ACKNOWLEDGEMENT

Thirteen excellent contributions are contained in this Country Issue of the Chinese Taipei Geotechnical Society (CTGS) as edited by Prof. Meei Ling Lin. All contributions are by authors from Taiwan and Prof. Meei Ling Lin must be congratulated for her excellent task. In the Preface Prof Lin have described in great detail the contributions from the authors. It is a pleasure to note that successful country issues are now completed by the Thai Geotechnical Society, The Vietnamese Society and now the Chinese Taipei Society. The contributions from Singapore, Hong Kong and Malaysia will also be released soon. Also, last but not least from Indonesia.

This issue also contains a special feature story on “Recent Diaphragm Wall Technologies and Future Challenges” by Hosoi Takeshi and Matsushita Shinya; a historical note on “Experiences of Geotechnical Development in Japan and Future Directions” by Masami Fukuoka and an “Obituary of Masami Fukuoka” by Fumio Tatsuoka. The passing away of Prof Masami Fukuoka on 27 January 2016 is a great loss to the engineering communities.

K. Y. Yong
N . Phienwej
T. A. Ooi
A. S. Balasubramaniam

GEOTECHNICAL ENGINEERING

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Editor: Professor Meei-Ling Lin

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Geotechnical Engineering Journal of the SEAGS & AGSSEA

Vol. 47 No. 4 December 2016

ISSN 0046-5828

GEOTECHNICAL ENGINEERING

Journal of the

SEAGS Southeast Asian Geotechnical Society

AGSSEA ASSOCIATION OF GEOTECHNICAL SOCIETIES IN SOUTHEAST ASIA

Sponsored by

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Thien Seng Yee, Swee Huat Chan and Teik Aun Ooi

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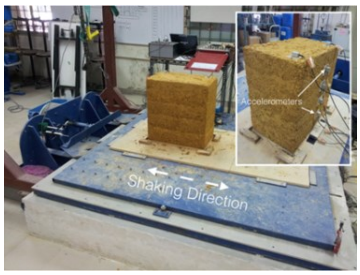

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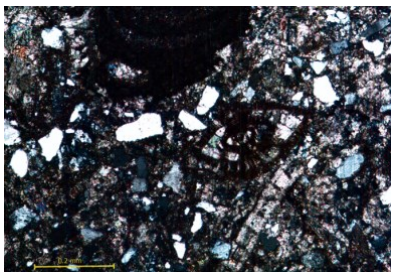

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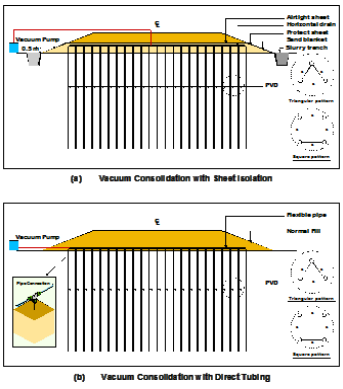

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PREFACE

The first paper is by Za Chieh Moh on Professionalism and ethics of geotechnical engineering. According to Moh, Ethics is the branch of philosophy that involves systematizing, defending, and recommending concepts of right and wrong conduct. Ethics is qualitative. It may change with time, circumstance and environment. Practice of ethics requires proper understanding of the time frame. Many professional engineering organizations have a set of Code of Ethics or Code of Practice to regulate or guide their members. Basically they all center around public welfare, sustainable development, professional competence, truthful and faithful, honourable, responsibly and lawfully. Success of engineering projects not only depends upon the engineering professional, but it also closely related to other non-engineering professionals. In the paper, discussions are presented about engineering ethics for non-engineering professionals. Ishihara in the Chin Fung Kee named lecture dealt with recent advances in pile testing and diaphragm wall constructions in Japan.

The second paper by Ishihara consists of brief introduction of the in-situ pile loading tests that have been conducted in Japan over the last two decades in connection with the design and construction of high-rise buildings in areas of soft soil deposits. In addition to the conventional types of tests in which the load is applied at the top and at the toe of the pile (O-cell test), what may be called “pile toe bearing test” and “skin friction test” is introduced. The results of these tests are described and compared with those from the conventional type of the pile loading tests. In-situ prototype tests are also introduced in which bearing power of Barrette type pile is compared with that of the circular type pile. A special case of in-situ pile loading tests conducted in Singapore is also introduced in which the friction between the circular ring-shaped concrete segment and the surrounding soil deposit was measured directly during excavation of the shaft by applying loads up and down by jacks installed between two adjacent segments in vertical direction. The latter part of this paper is a brief description on constructions of large-diameter circular diaphragm walls that was carried out about 10 years ago for the LNG storage tank in the coastal site in Tokyo Bay. The construction of the large-scale Kawasaki Island in the middle of Tokyo Bay in Japan will also be introduced. The whole scheme and process of construction is for these two undertakings is introduced with some comments on observed behaviour of the walls and on special precaution taken during construction.

The third paper by Jian Chu dealt with innovations in soil improvement methods. These include the dynamic replacement and mixing method for the improvement of peaty soil, the layered clay-sand method for land reclamation using clayey fill, and the biodegradable fiberdrains. Other new soil improvement methods in the related areas are also presented to illustrate the role of innovation in the advance of soil improvement technologies. These include the drainage enhanced dynamic compaction method for the improvement of clay layers, the underwater dynamic replacement method for the treatment of seabed clayey soil, the use of the vacuum preloading with horizontal drains method, methods to form working platform on top of soft fill for land reclamation using soft fill materials, the NEUSpace method for land reclamation in deep water, and the new types of prefabricated vertical drains (PVDs). Methods for mitigation of liquefaction hazard, making water pond in sand, and prevention of dike failure from overtopping using biotechnologies are also introduced.

The fourth paper by Poulos dealt with lessions learned from designing high-rise building foundations. The design of tall building foundations involves a systematic process which incorporates ground investigation, ground characterization, preliminary design of the foundation system for the anticipated structural loads, detailed foundation design, load testing of the proposed foundations, modification of the foundation design, if appropriate, and monitoring of the foundation performance as construction proceeds.

This paper also described the process and some of the tools available for implementing it. It then set out a series of lessons learned during the design of such foundations, and illustrate these lessons with examples from projects in Asia and the Middle East.

The fifth Paper by Buddhima Indraratna and his co-authors is on the subject of the Advancements in Rail Track Geotechnology at Increased Speeds and Axle Loads . Ballasted railroads are designed to provide high speed commuter and heavy haul transportation. Ballast is one of most important load bearing components of the track substructure. However, it often experiences excessive settlement, lateral deformation and particle breakage when subjected to large dynamic (cyclic and impact) stresses. In addition, tracks constructed along coastal areas often undergo large settlements over soft compressible estuarine deposits, leading to frequent and costly track maintenance. The use of artificial inclusions such as geogrids, geocomposites, shock-mats (rubber) and prefabricated vertical drains (PVDs) are attractive options to maintain the vertical and horizontal alignment of tracks and to curtail excessive maintenance costs. This paper provides a deeper insight to the recent advancements in rail track geotechnology at increased in speeds and axle loads.

The sixth Paper by P.V. Long and his co-authors is on the subject of "Performance and Analyses of Thick Soft Clay Deposit Improved by PVD with Surcharge Preloading and Vacuum Consolidation – A Case Study at CMIT". The authors discussed ground improvement using PVD for increasing foundation stability and controlling residual settlements of the container yard constructed on 35 m thick soft clay deposit at CMIT, Vietnam. The treated area is about 40 ha including vacuum consolidation combined with 6.3 m embankment surcharge for a strip of 57 m along the river bank (VCA) and conventional surcharge preloading using 9.1 m sand fill embankment for the remaining area. The monitored data indicated that PVD thickness of 3 mm arranged in spacing of 0.9 m to 1.2 m can be used successfully for improvement of thick soft clay deposit in both methods of embankment preloading with and without vacuum pumping. Performance of reduced embankment combined with vacuum pumping is very much better than that of conventional embankment preloading in terms of shortening construction time, reducing lateral displacement, increasing stability, and minimizing residual settlement. Back calculated ch value is dependent on the assumptions of smear effects including smear zone ratio, ds/dm and permeability ratio, Rs = kh/ks. For ds/dm = 2 as commonly used, the back-calculated ch value is directly proportional to Rs and the value of Rs in vacuum consolidation seems smaller than that in embankment preloading. Using the back-calculated results of compressibility and flow parameters, the time-settlements re-calculated by 1-D method are in very good comparison with measured data for both conventional preloading and vacuum consolidation considering the vacuum pressure as an induced vertical stress

distributed uniformly in the PVD zone. Analyses of factor of safety from observed pore pressures during embankment construction illustrated that the commonly used stability chart as given by Wakita & Matsuo (1994) is too conservative for PVD improved soft ground. Secondary compression behavior of thick soft ground improved by PVD including back calculation for coefficient of secondary compression and estimation of long term residual settlement are also provided.

The seventh paper is on the Characteristics of Hardpan calcrete of the Nyalau formation and impact on design of shallow foundations is by Sim et al. Nyalau Formation, found in Bintulu Division in Sarawak, Malaysia was formed by a thick array of shallow water marine and paralic sedimentary rocks. The formation is of predominantly sandstone origin and also the lesser known 'limestone' which is described as hardpan calcrete in this paper. Changes of sea levels during the mid-Pleistocene epoch resulting in the formation of raised terrace where marine deposits sedimented and subsequently followed by depositions of the coastal alluviums and inland peat swamps. Laboratory studies and design aspects of shallow foundations are described as well.

The eighth paper is by Seah et al is on ground improvement with vacuum consolidation method in Vietnam. In recent years, vacuum consolidation method has been extensively used in Vietnam on various types of infrastructural projects. The main reason for adopting this method is that the construction cost is relatively close to the conventional prefabricated vertical drain method with less surcharge fill and shorter construction time. Hauling or transporting large amount of fill has been a major problem in most infrastructure projects. With the stringent settlement requirements specified by the Vietnamese Government, ground improvement via vacuum consolidation has become very popular hence attracting various International vacuum consolidation specialists to participate in Vietnamese projects.

The ninth paper is by Tanaka & Lee deals with the dynamic properties of residual soils in Malaysia. The paper examines the dynamic deformation properties of a selected residual soil sample in Malaysia through a series of laboratory tests; including cyclic triaxial tests on the compacted residual soil with a measurement of deformation responses at small strains, and shaking table tests on a small soil block whereby the acceleration responses at different levels were analysed. The results showed that the dynamic deformation properties of the soil, namely the variation of shear modulus over a shear stain were ranging between 10-5 and 10-2.; the G values obtained were comparable to those published data.

The tenth paper is by Michael Dobie dealing with the pre-consolidation pressure of the Holocene marine clay of Malaysia. Prediction of the consolidation settlement of very soft alluvial clays in general requires knowledge of the compressibility characteristics of the deposit, but in particular it requires an accurate determination of the preconsolidation pressure. In the OC stress range settlements are likely to be relatively small, but once into the NC range, they can become very large. Therefore the accurate determination of the preconsolidation pressure is essential if reliable consolidation settlement predictions are to be made. This is examined in detail by back-analysing settlement data from two trial embankments which were built over 13m of Holocene marine clay at Juru (south of Butterworth), as part of the geotechnical investigations carried out for the North-South Expressway project over the period 1990 to

1991, then making comparisons to settlement calculated from measured compressibility properties. The definitive determination of preconsolidation pressure is derived from the behaviour of the trial embankment itself, which is then compared with assessments based on undrained shear strength, oedometer test results and piezocone tests.

Eleventh paper by Boon & Ooi deals with FEM analyses and t-z load transfer analyses on critical structures in Kuala Lumpur during tunnelling works. Three case histories are presented: The first one is on a 15 storey tower building seated on a raft foundation. Two modelling approaches were adopted to model the tunnel using the 2-D finite element software PLAXIS, namely the contraction method and the internal pressure method. The second one is on a flyover bridge, of which the pile toes are at an elevation higher than the tunnel crown; and the third one is on the piles of a Light Rail Transit (LRT) bridge in the vicinity of a tunnel. For the latter two case histories, the load transfer t-z and Q-z method (Seed & Reese, 1967), which can be implemented easily into a spreadsheet, to estimate the pile settlements induced by tunnelling is found to be applicable. Finally, insights obtained from the t-z and Q-z analyses are used to explain and refine the influence zones previously proposed by Jacobsz et al. (2004) derived from centrifuge tests. The line joining the points of inflection of multiple subsurface Gaussian settlement profiles (Mair et al., 1993) at different depths was found to correspond to the maximum settlement along the vertical profile, above which the settlement is always increasing.

In the twelfth paper, Tan & Ooi presented top down and bottom up methods of deep excavation in Kenny Hill Formation. The deep excavations are for the Klang Valley MRT underground stations; namely the Bukit Bintang and Merdeka stations which have similar retained depth of 33.5m and 31m respectively and both having 1.2m thick Diaphragm walls. Both the stations are designed with the same design criteria and factor of safety. The selection of type of retention systems, strutting system, construction sequences and timing and instrumentations are discussed.
The predicted and measured diaphragm walls displacements and Strut forces at different stages are then compared and discussed.

In the thirteenth paper Liew & Ho described the problems of Jack-in piling system in Malaysia causing large soil displacement inducing lateral and vertical movements of earlier installed piles, premature refusal to penetration of pile due to intermittent obstruction and also inadequate pile embedment due to shallow end bearing stratum. Pre-boring technique with or without infill are used to overcome the obstruction problem and to ensure adequate pile embedment. The proof loading pile termination criteria appears to produce favourable pile performance and quality assurance.
There are inherent long-term performance deterioration associated with shallow end bearing piles and incomparable short-term and long-term toe resistances, particularly in meta-sedimentary formation, which is prone to stress relief due to softening effect.

The fourteenth paper is by Lee et al on rainfall induced landslides in Malaysia. Landslide constitutes one of the major geohazards in Malaysia. The frequent landslide occurrences are mainly attributed to rainfall

(extrinsic factor) and tropical residual soil (intrinsic factor). This paper provides insights into the mechanisms of rainfall-induced landslides in the country and reviews efforts that have been taken to mitigate the hazard. Despite of the fact that local authorities, government agencies and practitioners have played their enormous roles in producing a better hillside development planning and control in the country, there are still areas for future improvement. The basic understanding of the unsaturated soil mechanics among practitioners and the laboratory facilities to support the theories still need to be enhanced. Besides, the country can move towards a better landslide risk control and management by advancing the studies in run-out behaviours of landslide, establishing database for soil profiles particularly in landslide prone areas, and switching to risk-informed approach of slope stability assessment.

The fifteenth paper by Tan et al is on the "Considerations of Deep Excavation in Kenny Hill and Kuala Lumpur Limestone Formations at the KVMRT". The paper described the constraints in excavation works in urban environment in the construction of underground space development in the KVMRT stations in the Kuala Lumpur city centre.

The sixteenth paper by W. Mao, I. Towhata, S. Aoyama and S. Goto is on the subject of Grain crushing under pile tip explored by acoustic emission. They thought that the recent practice in design of pile foundations under vertical load relies significantly on either a classic plasticity framework or empiricism. Despite efforts to explore the real pile behavior mainly in 1960s and 1970s, research interest has decreased in the recent times. Accordingly, much is not known about the group pile behavior that is more complicated than that of a single pile. One of the possible reasons for this poor situation is the lack of novel research methodology. In this regard, the authors chose the behavior of both a single pile and group piles subjected to vertical load, and carried out model tests using several new research tools. One important finding was the significant vertical compression of sand under the pile tips which was accompanied by crushing of sand grains. To further investigate the process of grain crushing, the acoustic emission (AE) method was introduced so that "when" and "where" of grain crushing might be identified through the interpretation of micro noise that was generated by crushing. Being different from early studies on AE in geotechnical materials, the present study paid attention to the frequency components of the noise and found that noise by grain sliding is of lower frequency while that by crushing exhibits higher frequency. This finding enabled the authors to interpret more accurately the recorded noise, and the timing and location of grain crush during pile penetration were identified. These findings were verified against the independent graphic interpretation of grain movement (PIV). Consequently, a close correlation between AE intensity and yielding of sand were identified. It is important that grain crushing occurs slightly below the elevation of the pile tip and sand immediately below the tip is significantly compressed but less prone to crushing.

The seventeenth paper is on test embankment supported by vibro stone column related to the high-speed rail project in Malaysia by Yee et al. The Ipoh-Padang Besar Electrified Double Track project is a multibillion-dollar high-speed rail project that involves installation of double tracks, electrification work, construction of stations, bridges and tunnels. Stringent performance specifications governed all aspects of

the project. Various ground improvement techniques were employed, among them Vibro stone columns. From 2008 to 2010, a low, instrumented test embankment supported by Vibro stone columns was built and monitored. The purpose was firstly to demonstrate that Vibro stone columns would not result in "hard points" at the surface even of a low embankment. The second purpose was to investigate the rest periods required for consolidation settlements to occur. Instrumentation and visual inspection show that no "hard points" were observed on the embankment surface, that Priebe's (1995) method adequately predicts the magnitude of settlements, and that Han & Ye's (2001) method adequately predicts the rate of settlements. The track has been operational since 2013, and settlement performance has been within the stringent specifications.

Editors:
Thien Seng Yee,
Swee Huat Chan
and Teik Aun Ooi

ACKNOWLEDGEMENT

Seventeen papers consisting of four Keynote and three Special Lectures from the recently completed 19th SEAGC and 2rd AGSSEAC which are upgraded together with ten contributed papers are contained in this Malaysia Special Issue. No doubt the material contained herein would be most valuable to our profession. The editors have adequately described the contributions in the preface. They are to be congratulated for these contributions.

Dr. Teik Aun Ooi
Prof. San Shyan Lin
Prof. Kwet Yew Yong
Prof. A. S. Balasubramaniam
Dr. Noppadol Phienwej

December 2016: MALAYSIA SPECIAL ISSUE

Edited by

Thien Seng Yee, Swee Huat Chan and **Teik Aun Ooi**

Ir. Thien Seng Yee

Ir. Yee graduated in civil engineering from the University of Malaya in 1978 and has over the years worked on projects largely involving heavy plant and building foundations as well as large infrastructures. He had also carried out numerous works on distress evaluations and rehabilitation engineering. In 1994, Ir. Yee set up his own practice, Geo.Consult, to support the construction industry with both expert and specialist advice; in particular on geotechnical engineering aspects. His participation in recent projects of significance are the Kuching Deep Water Port, Shah Alam Expressway, North-South Expressway, Kuantan Port Inner Harbour Development, Kuantan-Kertih Railway and the Rawang-Ipoh Double Tracking Railway. He has authored/co-authored more than a dozen technical papers in local and international conferences. Ir. Yee is an expert witness and accredited checker registered with the Board of Engineers Malaysia for the design of geotechnical engineering works. Ir. Yee is the Chairman of the Geotechnical Engineering Technical Division of the Institution of Engineers Malaysia for Session 2015/2016.

Ir. Dr. Swee Huat Chan

Ir. Dr. Swee Huat Chan is a registered Professional Engineer with the Board of Engineers, Malaysia since 2005. He graduated with a 1st Class Honors Degree in Civil & Structural Engineering from the Universiti Kebangsaan Malaysia in 1997. He obtained his Ph.D degree from the National University of Singapore in 2003. He worked as a Geotechnical Engineer in SSP Geotechnics Sdn. Bhd. for about 5 years before he joined Dr C.T. Toh Consultant as a Resident Engineer for about 2 years. He is one of the founders and directors of Geo-Excel Consultants Sdn. Bhd., a geotechnical engineering consulting firm. For the past 15 years, he has involved himself in analysis, design and construction of various geotechnical works and aspects including shallow & deep foundations, deep excavations & earth retaining structures, slope stability analyses & stabilization, landfill liner systems, seepage analyses, assessments of tunnelling methods, soil improvement techniques (highway, railway, airport, etc.), geotechnical failure investigations, 3-D finite element analyses, etc. He also served as an independent expert witness in several lawsuit cases in the High Court of Malaya at Kuala Lumpur. He is currently the Honorary Treasurer for Malaysian Geotechnical Society, Committee Member for the Geotechnical Engineering Technical Division in The Institution of Engineers, Malaysia and Member of Working Group on Drafting of Malaysia National Annex to Eurocode 7: Geotechnical Design - Part 2: Ground Investigation and Testing.

Ir. Dr. Teik Aun Ooi

Ir. Dr. Teik Aun Ooi obtained his Bachelor of Civil Engineering and Master of Engineering from Auckland Universiity in 1966 and 1968 respectively. He obtained his PhD from University of Sheffield in 1980. He was the Co - Organizing Chairman of the recently concluded SEAGC2016. He is the immediate Past President of the Southeast Asian Geotechnical Society (SEAGS), Founder Chairman of the Association of Geotechnical Societies in Southeast Asia (AGSSEA). He is a Past President of the Malaysian Institute of Arbitrators (MIArb). He is the Immediate Past ICE Country Representative for Malaysia (2000 - 2015), Founder Chairman of IEM Tunnelling and Underground Space Technical Division (TUSTD), Founder Chairman of IEM Consulting Engineering Special Interest Group (CESIG), He is an Honorary Fellow of The Institution of Engineers, Malaysia (Hon. FIEM), Fellow of the Institution of Civil Engineers (CEng FICE), Fellow of the MIArb (FMIArb), Fellow of Malaysian Society of Adjudicators (FMSA) and Fellow of Asean Academy of Engineering and Technology (FAAET). Dr. Ooi has fifty years of experience in the Construction Industry. He spent his initial fourteen years with the Public Works Department Malaysia before leaving to work in the private sector where he spent seventeen years working in the construction sector. He play major role in the Johore Baru Causeway widening and the design and construction of Senai Airport in 1970s. He was the Project manager for the Wisma Saberkas Building Project in Kuching in 1980s. He was Project Director for the Design and Construction supervision of the New Kuching Deep Water Port at Kampung Senari in 1990s. He started his consultancy practice in 2000 specialising in Civil and Geotechnical Engineering works. Dr. Ooi is a practicing Consulting Engineer, An Expert Witness in Court and in Arbitration, An Accredited Checker, An Arbitrator and An Adjudicator. He is a member of the Accredited Checker Committee of the Board of Engineers, Malaysia. Dr. Ooi devoted much of his time in honorable public service in continuing education of engineers and development of Malaysia Annexes for Eurocode 7 and 8. He is an independent executive director of IEM Training Centre Sdn Bhd since 1992. In 2013 he was appointed executive director of the IEM Academy Sdn Bhd. He has been Organizing Secretary and Chairman of numerous IEM Workshops, Seminars, and Conferences since 1970s. He was responsible for forming five active ICE Student Chapters in Universities in Kuala Lumpur. Dr Ooi conducted touring lectures in geotechnical engineering to Malaysia, Vietnam, Thailand, Cambodia, Laos, Myanmar and Philippines. In Malaysia he was invited to deliver the prestigous 19th Professor Chin Fung Kee Memorable Lecture in 2009. He frequently delivered lectures to the final year University engineering students.

GEOTECHNICAL ENGINEERING

December 2016: MALAYSIA SPECIAL ISSUE

Edited by

Thien Seng Yee, Swee Huat Chan and **Teik Aun Ooi**

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