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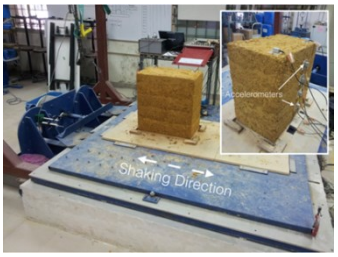
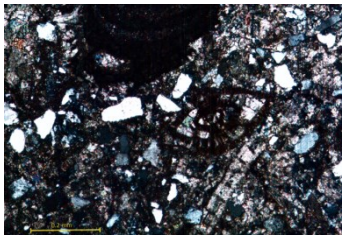


Shaking table test on soil block (After Tanaka and Lee, 2016)



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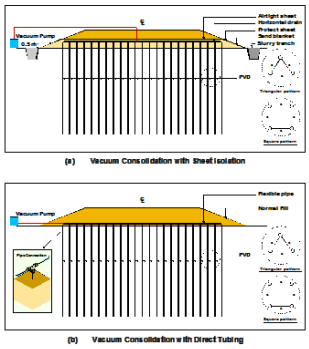

Vacuum Consolidation, Vietnam (After Seah et al, 2016)

Bird-eye view of pier platform (After Ishihara, 2016)

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GEOTECHNICAL ENGINEERING

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".** 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 Ikuo Towhata & Wuwei Mao , 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.

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GEOTECHNICAL ENGINEERING

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Edited by

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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.

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Ir. Dr. Chan Swee Huat 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

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

TABLE OF CONTENTS

List of Papers

Cover Photographs:

1. Photo 1 Weathering profile of tropical residual soil (After Lee, Tanaka and Chong, 2016)
2. Photo 2 Shaking table test on soil block (After Tanaka and Lee, 2016)
3. Photo 3 Jeddah Tower, Saudi Arabia (After Poulos, 2016)
4 Photo 4 Burj Khalifa Tower, Dubai (After Poulos, 2016)
5 Photo 5 Vacuum Consolidation, Vietnam (After Seah et al, 2016)
6. Photo 6 Debris flow in Keningau, Sabah, on 26th December 1996 (After Abdullah et al., 2016)
7. Photo 7 Bird-eye view of pier platform (After Ishihara, 2016)

GEOTECHNICAL ENGINEERING

Paper Contribution, Technical notes and Discussions

SEAGS & AGSSEA encourage the submission of scholarly and practice-oriented articles to its journal. The journal is published quarterly. Both sponsors of the journal, the Southeast Asian Geotechnical Society and the Association of Geotechnical Societies in Southeast Asia, promote the ideals and goals of the International Society of Soil Mechanics and Geotechhnical Engineering in fostering communications, developing insights and enabling the advancement of the geotechnical engineering discipline. Thus the publishing ethics followed is similar to other leading geotechnical journals.Standard ethical behaviour of the authors, the editor and his editorial panel, the reviewers and the publishers is followed.

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Geotechnical Engineering Journal accepts submissions via electronic. The manuscript file (text, tables and figures) in both words and pdf format together with the submission letter should be submitted to the Secretariat and copied to the Editor-in-Chief, Geotechnical Engineering Journal, c/o School of Engineering and Technology, Asian Institute of Technology, Room no. 211, AIT Library, Asian Institute of Technology, P.O. Box 4, Klong Luang, Pathumthani 12120, Thailand. Email: seags@ait.ac.th. Papers under review, accepted for publication or published elsewhere are not accepted. The guidelines for author are as follows:-

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14. REFERENCES

American Petroleum Institute (API) (1993). Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms – Working Stress Design, API Recommended Practice 2AWSD (RP 2A-WSD), 20th edition, 1993, p191

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