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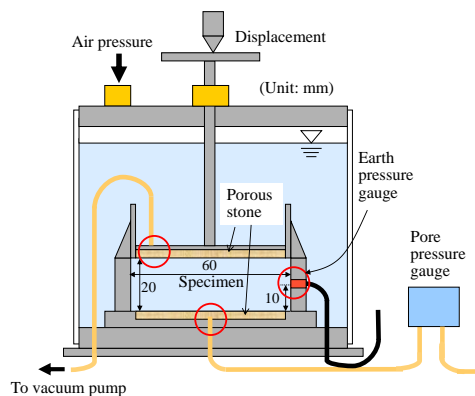


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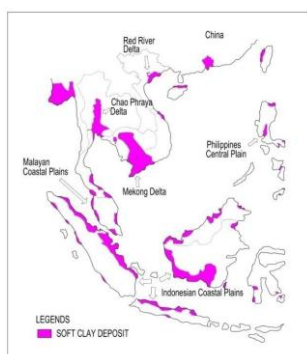


(a) Vertical drainage test set up



(b) View of the consolidation cell

1. Vacuum and Surcharge Loadings in Oedometer Test (after Chai *et al*, 2013)



2. Distribution of Soft Clay Deposits in Southeast Asia (after Long *et al*, 2013)



3. Deep mixing using High Pressure Jet Grout (after Kitazume, 2013)

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Preface

This special issue is dedicated to Professor Dennes T. Bergado to commemorate his retirement from the Asian Institute of Technology (AIT) in June, 2013. The general theme of this issue is: Soft Ground improvement and Geosynthetics, which has been the main area of Prof. Bergado's personal research activity over the past 3 decades and to which he has contributed enormously. The idea of having a special issue for Prof. Bergado's retirement came from Prof. A. S. Balasubramaniam in March 2012. When he asked us to be guest editors for this issue, we accepted the invitation happily and eagerly. Prof. Bergado was Prof. Jinchun Chai's supervisor for his Doctor of Engineering Degree in AIT (1992), and he is also a close friend of Prof. Shuilong Shen.

We were determined to make the issue one of very high standards and a lasting and memorable contribution to the subject area. We started to invite active researchers in the field to contribute their new research results or state-of-the-art papers in April 2012. All those we invited responded warmly and enthusiastically, and we believe this was because of Prof. Bergado's outstanding contribution to the field as well as his friendly personality. We informed all who agreed to contribute that all papers would be subject to strict critical review and only those papers that satisfactorily addressed all review comments would be finally included in this issue. Thirteen (13) full papers were received by the end of 2012. Review and revision works took about 4 months and in May 2013, the 13 high quality papers were finally accepted and ready for publication. Among these papers, 7 are review articles, i.e., state-of-the-art papers, and 6 contain essentially new and previously unpublished material.

In the meantime, we invited senior professors in the field of geotechnical engineering who know Prof. Bergado well to write their thoughts and reflections about him for this special issue. The notes penned by Prof. H.G. Poulos, Prof. S.K. Kim & Prof. N. Miura are included with this preface. It is hoped that these short notes will provide inspiration to young researchers and engineers working in the area of ground improvement and the application of geosynthetics.

Finally we would like to thank all the contributors and people who helped us to make this special issue a success. We wish Prof. Dennes T. Bergado a very happy retirement and at the same time urge him to continue to contribute professionally to the fields of soft ground improvement and the use of geosynthetics. We feel he still has much to offer to our profession.

Jinchun Chai , Saga, Japan
Shui-Long Shen Shanghai, China

Prof. H.G. Poulos writes

Ground improvement has become an increasingly important issue in the development of property and infrastructure in areas where ground conditions are poor. South East Asia is one of these areas and so it is entirely appropriate that research into ground improvement methods should be undertaken at one of the region's foremost institutions, the Asian Institute of Technology (AIT). This research has been spearheaded by Professor Dennes T. Bergado, and over the past 3 decades, he and his research team have made many significant contributions to knowledge and practice in the area of ground improvement. Of particular significance is his work on vertical drains and ground reinforcement using inclusions and geosynthetics. He has presented innovative techniques to enhance the performance of vertical drains by heating them, and by the application of electro-osmosis. His two books in this area have been influential and have been of great value to students and practitioners alike.

A feature of Professor Bergado's research is his focus on solving geo-problems in Asia, and his recent research has expanded to include geotechnical aspects of natural disasters, including tsunamis. He and his team have addressed not only the science of the problems they have tackled, but also the technology of application of the science.

AIT has been fortunate to have a person of his calibre to lead the group and to carry on the pioneering work that began decades ago with Dr. Za-Chieh Moh, and continued under Professor A. S. Balasubramaniam. I am sure that I speak for many in our discipline in wishing him an enjoyable retirement, while at the same time hoping that he will be able to continue to contribute his knowledge and experience to the profession and to help guide the younger generation of geo- professionals.

H.G. Poulos
Coffey Geotechnics, and the University of Sydney, Australia.
December 2012.

Prof. Sag-Kyu Kim writes

First of all, I would like to congratulate Professor Dennes T. Bergado on his honourable retirement from AIT. He has long served at the institute as an educator of geotechnical engineering. Through his long teaching career at AIT he has produced a lot of prominent geotechnical engineers, most of whom are now doing leading roles in the Asian region. His research works have mainly been concerned in soft ground improvement and geosynthetics. Lots of papers related to this discipline have been published in international journals and proceedings. Furthermore, he has been involved in important consulting projects including the construction of the new Bangkok international airport. His reputation as an expert in this field has made him to be invited as a theme lecturer or a keynote speaker in many international geotechnical events. It is my honour and privilege to write some words for such an expert in a special volume of *Geotechnical Engineering Journal* commemorating his academic achievements.

Everywhere in the world there exist soft grounds that need to improve for an effective land use. A large delta neighbouring the city of Busan in Korea was also one of such sites, where the Government planned to develop a large scale harbour along a coastline and residential and industrial compounds behind it. In connection with this challenging project, I opened a short course on 'Soil improvement using prefabricated vertical drains' in 1998 at my University in Seoul. Prof. Dennes T. Bergado gave a practically useful lecture at the event with the theme of 'Design and analysis of vertical drains' and introduced the case of soil improvement of Bangkok clay. Afterwards, I again organized an Asian Regional Committee entitled 'Thick clay deposit,' and I have frequently held seminars and symposia in order to expand and deepen the understanding of ground improvement technologies. He often joined us in those events as an invited speaker and thus through those close contacts he became my long-time colleague and friend. We are deeply indebted to Prof. Dennes T. Bergado for having shared his experiences and introduced new technologies developed at AIT.

Though he is retiring from teaching and research duty at AIT, he is still young and energetic. I am sure he will continue to work with a new role in our geotechnical field. I wish him all the best and enjoying his second career.

Sag-Kyu Kim
Professor Emeritus, Dongguk University, Seoul, Korea.
December 2012.

Prof. N. Miura writes

Bergado – All rounded Player

It was in 1987 when I first contacted with Prof. Dennes T. Bergado who was working at Asian Institute of Technology (AIT) in Bangkok, Thailand immediately as a young faculty member after he came back from U.S.A. Saga University asked me to invite a foreign professor, and I sent invitation letters to several universities. He sent back his positive response to accept our requirements. We were planning to establish a new institute to investigate the lowland problems especially such problems as land-subsidence, soft ground improvement, and water management in lowlands. Prof. Dennes T. Bergado was searching for new research topics after he finished probabilistic research in his PhD dissertation at Utah State University under Professor Loren Anderson. Prof. Dennes T. Bergado was interested in soft ground improvement in Saga Plain, because there exist common properties between soft Ariake Clay in Saga Plain and soft Bangkok clay.

The first topics he selected at Saga University were to investigate the prefabricated vertical drain (PVD). We made a large-scale test instrument for this purpose and he successfully performed experimental model tests. The results were successfully applied in field embankment tests at Saga Airport construction site. Some of the data appeared on his book publication “Soft Ground Improvement in Lowland and Other Environments” published by ASCE press (Bergado, Anderson, Miura and Balasubramaniam, 1996). Subsequently, this equipment has been utilized for model tests in the soft Bangkok clay which lead to successful applications in the Mega-Projects in Bangkok, Thailand such as the Suvarnabhumi International Airport, Motorway to Pattaya, Outer Ring Road, etc.

During Prof. Dennes T. Bergado’s stay at Saga University, close relationship was made with AIT, and Saga University accepted more than ten AIT alumni for doctoral studies. During Bergado’s second stay, then AIT President, Prof. North, visited our University. After he went back to AIT, tremendous activities started in the field of geotechnical engineering. Field tests on full-scale embankments at AIT campus became a well-known monuments, and he published numerous papers based on the model embankments, and a large number of doctor students were produced at AIT.

Prof. Bergado’s brilliant successes come not only from his creative and innovative researches but also his pleasant personality which attracted excellent students and also practicing engineers. In other words, he has a good sense of management. He is really an all-around player. I hope that he can continue his research activities after retirement and also he can enjoy golf as long as he can. I would like to say many thanks to him for his contribution to our activities at Saga University which led to the establishment of the Institute of Lowland Technology (ILT). Lastly, he also contributed in initiating the now famous International Symposium on Soil Reinforcement (now IS-Kyushu) which started at Saga University in 1988. He was also instrumental in the establishment of the technical journal at ILT called Lowland Technology International (LTI), a name Prof. Dennes T. Bergado suggested.

Norihiko Miura
December 2012

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ACKNOWLEDGEMENT

It is a great pleasure to write this acknowledgement for the December 2013 Issue dedicated to honour Prof. Dennes T. Bergado's retirement from the Asian Institute of Technology. At the very first sincere thanks must go to the guest editors Prof. Jinchun Chai and Prof. Shuilong Shen. They really did a magnificent job in making this volume possible with thirteen excellent papers; all related to ground improvement and from world-wide reputed authors.

Grateful acknowledgement is also made to the contributing authors: J.-C. Chai, J. P. Carter, A. Saito and T. Hino; Ennis M. Palmira, André R.S. Feel and Gregorian. L. S. Araújo; X. Yang and J. Han; J. K. Lee and J.Q. Shang; P.V. Long, D.T. Bergado, L.V. Nguyen and A.S. Balasubramaniam; Han-Yong Jeon and Yuan Chun Jin;

P. Voottipruex and D.T. Bergado, and W. Wongprasan; C. Taechakumthorn and R.K. Rowe; C. Rujikiatkamjorn and B. Indraratna; Z.F. Wang, S.L. Shen, C.E. Ho and Y.H. Kim; Masaki Kitazume; Wei Guo, Jian Chu and Shuwang Yan; S. Horpibulsuk, C. Suksiripattanapong and A. Chinkulkijniwat; and H.M. Abuel-Naga, G.A. Lorenzo and D.T. Bergado.

There are fourteen excellent papers in this issue on: Behaviour of Clay Subjecting to Vacuum and Surcharge Loading in an Oedometer; Behaviour of Geogrid Reinforced Abutments on Soft Soil; Geocell-Reinforced Granular Fill under Static and Cyclic Loading: A Synthesis of Analysis; Electrical Vertical Drains in Geotechnical Engineering Applications; Design and Performance of Soft Ground Improvement Using PVD with and without Vacuum Consolidation; Reassessment of Long-Term Performance of Geogrids by Considering Mutual Interaction among Reduction Factors; Simulations of PVD Improved Reconstituted Specimens with Surcharge, Vacuum and Heat Preloading using Axisymmetric and Equivalent Vertical Flow Conditions; Reinforced Embankments on Soft Deposits: Behaviour, Analysis and Design; Current State of the Art in Vacuum Preloading for Stabilising Soft Soil; Jet Grouting Practice: an Overview; Deep Mixing Method in Japan; Recent Studies of Geosynthetic Tubes and Mattress: an overview; Design Method for Bearing Reinforcement Earth Wall; and Current State of Knowledge on Thermal Consolidation using Prefabricated Vertical Drains.

Prof. Bergado (Dennes) was in the Geotechnical Engineering batch that graduated from AIT in 1976. At that time, Dr. Moh, Dr. Brand, Dr. Peter Brenner and Prof. Prinya Nutalaya and Prof. A.S. Balasubramaniam were the Geotechnical Faculty Members at AIT. After working for a while in Philippines, Prof. Bergado studied at Utah State University in USA on a Full Bright Scholarship and worked with Prof. Loren Anderson. Prof. Bergado joined AIT as an Assistant Professor in 1982; early colleagues of Prof. Bergado at AIT include Prof. Hideki Ohta, Prof. Towhata, Late Dr. Tomiolo, Dr. Friedrich Prinzl, Prof. Ikuo Towhata, Prof. Yuhdbir and Dr. Sarvesh Chandra. Later, Dr Robert Whitely, Dr. Noppadol Phienweij, Dr. Rantucci, Prof. Buddhima Indraratna, Dr. Kuwano, Dr. Sugimoto, Dr. Honjo, Prof. Ohtsu, Prof. Shibuya and Dr. Takemura; just to name a few. Prof. Onodera and Prof. Toshinobu Akagi left AIT a little before Prof. Bergado joined AIT.

At AIT in the early years Prof. Bergado was involved with many major Sponsored Research Projects including the USAID Funded Welded Wire Mechanical Stabilized Earth and Geosynthetics in Embankments on Soft Clays. Prof. Bergado was also deeply involved with the PVD Soft Ground Improvement Project at the Second Bangkok (Suvarnabhumi) Airport Site with the Airport Authority of Thailand. The Doctoral Students of Prof. Bergado were: Prof. Shivashankar, Prof. Chai, Dr. Long, Dr Panich, Dr Lorenzo, Dr Sompote, Dr Lai, Dr Abuel-Naga, Dr Chairat, Dr. Pittaya, Dr Jaturonk, and Dr

Tawatchai to name a few. He successfully supervised a total of 17 doctor and 160 master graduates. Prof. Bergado wrote 2 books in soil/ground improvement, edited 22 conference proceedings with more than 140 journal and 280 conference papers. Prof. Bergado also edited the Volume on Geotechnical Engineering in SE Asia for the Golden Jubilee Conference at San Francisco in 1985. Prof. Bergado was associated with the Southeast Asian Geotechnical Society from the time he joined AIT, earlier as Editor of the Journal (1996-2000) and later became the Secretary General of SEAGS (2001-2012). He also initiated the Asian Center for Soil Improvement and Geosynthetics (ACSIG) and founded the International Geosynthetics Society (IGS)-Thailand Chapter. Currently, he is serving his second term as elected member of the IGS International Council.

Prof. Bergado spent his Sabbatical at Saga University. Emeritus Professor Norihiko Miura has also contributed an article here on Prof. Bergado's contributions and so were Prof. H G Poulos and Prof. Sag-Kyu Kim. These articles are included in the Preface as written by the Guest Editors.

It is a genuine pleasure to have this special issue to honour Prof. Dennes T. Bergado who has been an AIT Alumnus, a Colleague and friend of all of us over the last 35 years or so.

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

GEOTECHNICAL ENGINEERING

DECEMBER 2013 SPECIAL COMMEMORATIVE ISSUE IN HONOUR OF PROF DENNES T. BERGADO ON HIS RETIREMENT FROM AIT

Editors: Jinchun Chai & Shui-Long Shen

PROF. JINCHUN CHAI

Prof. Chai got his bachelor of engineering degree from Tongji University in Shanghai, China in 1982; and master of engineering degree from the China Academy of Railway Science in Beijing, China in 1985. Then he got his Doctor of engineering degree from Asian Institute of Technology in Bangkok, Thailand in 1992 under the supervision of Prof. D. T. Bergado. Professor Chai is currently Professor of Geotechnical Engineering at the Department of Civil Engineering and Architecture, Graduate School of Science and Engineering, Saga University, Japan. His primary research interests are: (1) soft ground improvement; (2) geosynthetics; and (3) numerical analysis in geotechnical and geoenvironmental engineering.

He has written over 140 research papers (about 60 journal papers and over 80 conference papers) and two coauthored books, “Improvement techniques of soft ground in subsiding and lowland environment”, by :Bergado/Chai/Alfaro/Balasubramaniam; Balkema (1994); and “Deformation analysis in soft ground improvement”, by Chai/Carter; Springer (2011). In Scopus database, his papers have been cited about 750 times, and his H-Index is 16. Professor Chai is a licensed Professional Engineer in Japan.

PROF. SHUI-LONG SHEN

Prof. Dr. Shui-Long Shen received his BSc. in Tunneling and Underground Space Technology from Tongji University in 1986 and his MPhil in Structural Engineering from the same university in 1989. He obtained his Ph.D. in Geotechnical Engineering from Saga University, Japan, in 1998. After Dr. Shen received his PhD, he worked in the Institute of Lowland Technology (ILT) as a lecturer from 1998 to 2001. During this period Dr. Shen served as an Associate Editor of Lowland Technology International-an International Journal. From 2001 to 2003, Dr. Shen worked in National Institute for Environmental Studies in Tsukuba-the Science City of Japan. In 2003, he joined the Department of Civil Engineering (DCE) of Shanghai Jiao Tong University (SJTU) as a faculty member. He is now the Department Head of DEC. From 2005 to 2010, Dr. Shen has been keeping collaboration with other international organization, e.g. Saga University, Virginia Tech, The University of Kansas, The University of Hong Kong, Suranaree University of Technology.

Dr. Shen’s research interests focus on **soft ground improvement** and **land subsidence** due to withdrawal of liquid from underground. He published and/or edited five books, of which two conference proceedings published by ASCE. Dr. Shen published more than 150 technical papers in Journals and conferences, in which about 50 papers were published in International Journals.

Dr. Shen also serves as an editorial board member of four International Journals, e.g. *Geotextiles and Geomembranes*, Elsevier, and **Geotechnical Engineering** – SEAGS etc. and two domestic journals, e.g. Chinese Journal of Geotechnical Engineering.

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**December 2013: Commemorative Issue on
Prof. D. T. Bergado's Retirement from AIT
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Cover Photographs:

1. Vacuum and Surcharge Loadings in Oedometer Test (after Chai *et al*, 2013)
2. Distribution of Soft Clay Deposits in Southeast Asia (after long *et al*, 2013)
3. Deep mixing using High Pressure Jet Grout (after Kitazume, 2013)

GEOTECHNICAL ENGINEERING

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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 2AWS (RP 2A-WSD), 20th edition, 1993, p191
- Earth, J.B., and Geo, W.P. (2011) "Asian Geotechnical amongst Authors of Conference Publications", Proceedings of Int. Conference on Asian Geotechnical, publisher, city, pp 133-137.
- Finn WDL and Fujita N. (2002) "Piles in liquefiable soils: seismic analysis and design issues," Soil Dynamics and Earthquake Engineering, 22, Issues 9-12, pp731-742
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