Geotechnical Engineering Journal of the SEAGS & AGSSEA

Vol. 51 No. 3 September 2020

ISSN 0046-5828

GEOTECHNICAL ENGINEERING

Journal of the

SEAGS Southeast Asian Geotechnical Society

AGSSEA ASSOCIATION OF GEOTECHNICAL SOCIETIES IN SOUTHEAST ASIA

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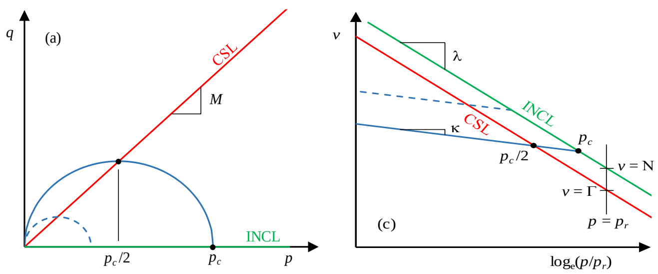
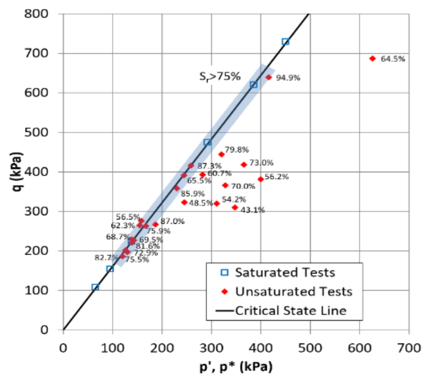
Honouring Prof. John Burland
Dedicated to late Prof. Kenneth Harry Roscoe

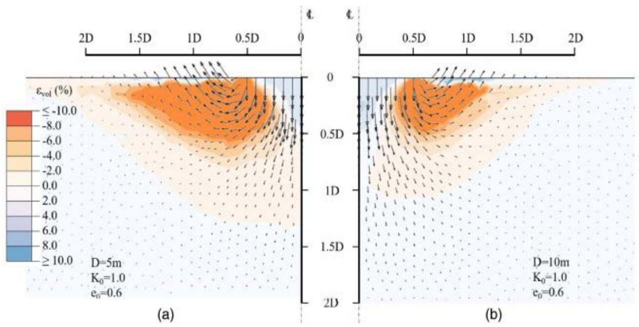
Guest Editors: Prof. Buddhima Indraratna and Prof. Andy Fourie



An Appreciation of Modified Cam Clay, after G. T. Houlsby (2020).



Stress Components in Unsaturated Soils, after D. G. Toll (2020).



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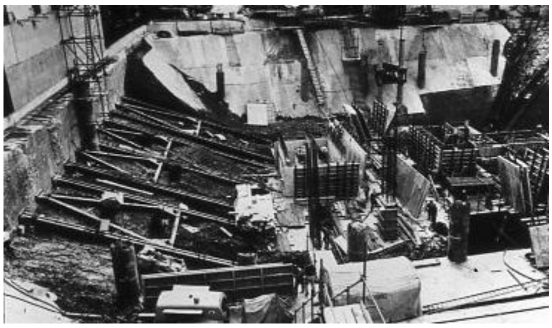
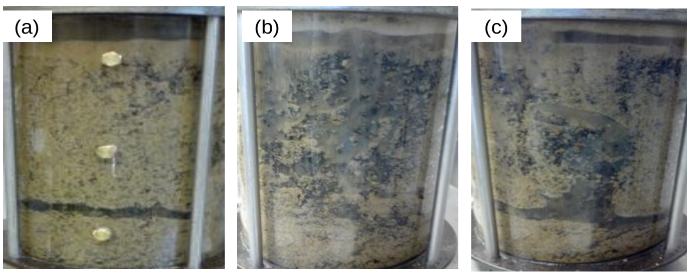
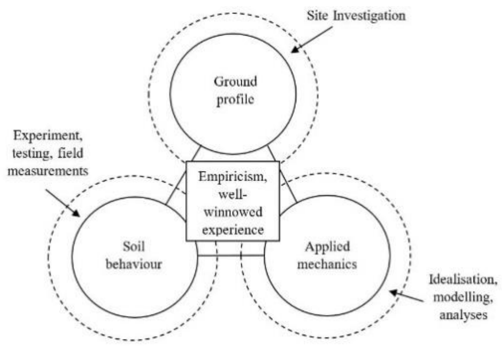


John Burland's Deep-Excavation- and Tunnelling-Related Research and Industry Involvement, after J. R. Standing (2020).

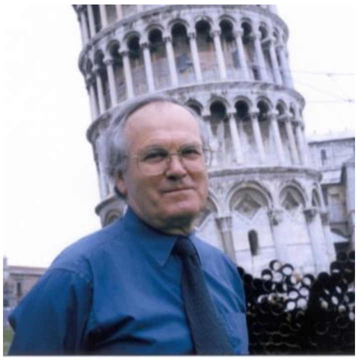


From Particles to Constrictions: Scientific Evolution of Enhanced Criteria for Internal Stability Assessment of Soils, after Indraratna et al. (2020).



Reflections on Recent Tailings Dam Failures and How the Application of Burland's Soil Mechanics Triangle Concept May Avert Future Failures, after A. Fourie (2020).

BIOGRAPHY OF PROFESSOR BURLAND



Honouring Professor John Burland

Professor John Burland, CBE, DSc (Eng), FREng, FRS, NAE, FIC, and FCGI, was educated in South Africa and studied Civil Engineering at the University of the Witwatersrand. After obtaining his BSc degree in 1959, he stayed on as a Research Assistant to Professor Jennings and carried out research on the development of silt pressures behind dam walls – work that would prove valuable to him later on. He then enrolled for the MSc degree, and his Master's thesis was on the concept of effective stress in unsaturated soils. He concluded that there were severe limitations in applying the effective stress principle to the prediction of volume changes in unsaturated soils because changes in suction give rise to microstructural changes which are different from those generated by equivalent changes in boundary stresses. He argued that suction and total stress should, therefore, be treated as independent variables. This seminal work was published with Jennings in *Géotechnique* in 1962 and is still widely referred to. In 1962 John Burland returned to England and joined Ove Arup and Partners (now Arup). During his interview, he was told that he would never do soil mechanics again as the firm was primarily structural and architectural! However, shortly before joining, the firm won a commission for the design of the then tallest office building in the City of London (Britannic House) which was founded in a deep and extensive basement. Because of his background in soil mechanics, John Burland was assigned to work on this project, thereby launching his career as a geotechnical engineer.

Following a visit to meet Roscoe in Cambridge to find out more about the work being developed on Critical State Soil Mechanics, John Burland enrolled there as a Research Student with Roscoe as his supervisor in September 1963. His objective was to research the application of the new Critical State theories to practical deformation problems in foundation engineering. Following on from his earlier work on silt pressures against dam walls, he realized that a key starting point for many boundary value problems is the initial 'at rest condition' in which the initial horizontal effective stress is given by the coefficient of earth pressure at rest K_o. He argued that, in addition to this initial at-rest condition, an isotropic model should also reproduce isotropic compression under isotropic stress, and it should also produce continuing shearing with zero volume change at the Critical State condition. The original Cam Clay model satisfied the required Critical State condition but gave poor agreement with measured K_o values and gave indeterminate strain ratios under isotropic stress (because of the pointed shape of the plastic potential). If practical soil mechanics problems were to be solved, he felt that the model should satisfy the isotropic stress condition and, more importantly, the initial earth pressure at rest condition. He, therefore, developed a modification to the original Cam Clay model which gave satisfactory values of K_o and isotropic strains under isotropic stress. This became known as the Modified Cam Clay (MCC) Model, and it makes use of an elliptical plastic potential. The proposed model was first put forward in a letter to *Géotechnique* in 1965, and a full paper was published with Roscoe in 1968 which is still widely referenced. There have been numerous subsequent developments of the basic MCC model to account for such features as anisotropy, bonding, kinematic plasticity etc. Most of them incorporate the basic elliptical plastic potential.

Dr. Burland joined the Building Research Station in 1966, became Head of the Geotechnics Division in 1972 and Assistant Director in 1979. While at the later named Building Research Establishment (BRE) his research was devoted to the measurement of movements of and around a variety of structures (including buildings, deep excavations and tunnels) during and subsequent to construction in a wide range of ground conditions. One of the most notable structures that he worked on was the deep underground car park in New Palace Yard, Westminster. In 1980 he was appointed to the Chair of Soil Mechanics at the Imperial College of Science, Technology and Medicine. He is now Emeritus Professor and Senior Research Investigator at Imperial College.

In addition to being very active in teaching (which he loves) and research, John Burland has been responsible for the design of many large ground engineering projects. He specializes in problems relating to the interaction between the ground and masonry buildings. He was London Underground's expert witness for the Parliamentary Select Committees on the Jubilee Line Extension and has advised on many geotechnical aspects of that project, including ensuring the stability of the Big Ben Clock Tower. He was a member of the international board of consultants advising on the stabilization of the Metropolitan Cathedral of Mexico City and was a member of the Italian Prime Minister's Commission for stabilizing the Leaning Tower of Pisa. He has provided expert advice on many overseas projects, including extensive tunnelling in Hong Kong and Singapore and worked on the third runway at Hong Kong Airport.

He has received many awards and medals, including the Kelvin Gold Medal for Outstanding Contributions to Engineering, the Harry Seed Memorial Medal of the American Society of Civil Engineers for distinguished contributions as an engineer, scientist and teacher in soil mechanics and the Gold Medals of the Institution of Structural Engineers, the Institution of Civil Engineers and the World Federation of Engineering Organizations. He has been awarded six Honorary Doctorates, and he is a Fellow of the Royal Academy of Engineering, the Royal Society and is a Foreign Member of the US National Academy of Engineering. In 2002 he was the President of the Engineering Section of the British Science Association, and he was Vice President (Engineering) of the Institution of Civil Engineers, London from 2002 to 2005. In 2005 he was appointed CBE for services to Geotechnical Engineering.

Prof. Burland retired from full-time teaching in 2004. However, he continues to teach on the MSc course and assists in current research in soil mechanics and geotechnical engineering in his position as Emeritus Professor and Senior Research Investigator at Imperial.

PREFACE

This Special Issue of the Journal of the Southeast Asian Geotechnical Society has been compiled to celebrate the contributions of Emeritus Prof. John Burland to the development of Geotechnical Engineering worldwide. The launching of such a Special Issue was the brainchild of Prof. A. S. Balasubramaniam (Bala) of Griffith University, and Distinguished Professor Buddhima Indraratna of the University of Wollongong and Professor Andy Fourie (University of Western Australia) volunteered as the Guest Editors. Prof. Indraratna was taught by Prof. Burland while being an undergraduate and as a Master's student at Imperial College, and Prof. Fourie a Ph.D. student at Imperial College in the 1980s.

John Burland had an enormous impact in both academia and industry, as is evident from his biography. This Special Issue set out to capture the essence of these contributions by assembling papers by his ex-students and colleagues who have benefitted so much from working with him and from being taught and supervised as graduate students by him. This Special Issue is thus a timely tribute in kind, demonstrating the influence on our profession that goes beyond just his personal contributions, but also his contributions through interactions with, and mentoring of many geotechnical engineers currently working in academia or within the Civil Engineering industry worldwide.

Papers for this Special Issue were by invitation of the Guest Editors. Prof. Indraratna and Prof. Fourie approached authors with a request to produce bespoke contributions that they felt reflected the benefits, direct or indirect, that resulted from working with John and inspired by him. Although there are a number of other researchers and practitioners who have benefited from their association with John, it was necessary to limit contributions, and the Guest Editors sincerely hope the papers compiled in this Special Issue will be of immense interest to readers and adequately honour the contributions of John Burland to our profession.

The invited contributions serving this Special Issue cover a range of topics, from fundamental constitutive model considerations that capture both saturated and partially saturated soils, a range of experimental procedures, field instrumentation and monitoring of full-scale structures and approaches to making sense of such observations.

Over the years, the Modified Cam Clay (MCC) theory developed by Roscoe and Burland (1968) has been instrumental in the advancement of constitutive modelling of soils. In the first paper, **Houlsby, G. T.** revisits the MCC framework (RB68), highlights its versatility by presenting various features of the model and how it forms the basis for many sophisticated constitutive models. The paper elucidates RB68 not only as a simple conceptual model but also as a scientific medium by engaging researchers into understanding the fundamental features of soil behaviour.

The second paper by **Jardine, R. J.**, **Hight D. W.**, and **Potts, D. M.** lays emphasis on their joint research conducted with Prof. John Burland in pioneering the offshore energy production platforms in the North Sea. The paper asserts the importance of understanding regional geology, along with the laboratory and numerical approaches which have had a lasting impact in many areas of geotechnical engineering. The article also presents two case studies highlighting the subsequent development of the pile design methods which are now shifting the attention of the world towards renewable and sustainable energy production.

The third paper is by **Toll, D. G.** It sheds light on Prof. Burland's contribution in critiquing Bishop's (1959) approach of combining the stress components in unsaturated soils with a single empirical factor. The paper reinterprets the triaxial test results of unsaturated lateritic gravel and upholds that a single variable is not sufficient to fully predict unsaturated soil behaviour.

The next article is by **Whittle, A. J.** and focusses on the significance of non-linearity in the stress-strain behaviour of soils at very small strain levels. The author reflects on Prof. Burland's seminal Bjerrum Lecture '*Small is beautiful*'(1989) and reviews the importance of non-linear stiffness in advancing the knowledge of soil behaviour, in developing reliable constitutive models and evaluating the impact of the computed performance for practical situations.

The following article by **Georgiannou, V. N.**, **Pavlopoulou, E-M** and **Chortis, F. C.** reports the laboratory response of sand stabilized with colloidal silica aqueous gel. The results indicate an anomaly in the behaviour of treated sands such that, depending on the loading conditions, while the strength and the compressibility increase, the stiffness may reduce. This contribution neatly demonstrates that chemical grouting using colloidal silica hydrosol may not be the remedy for all maladies of liquefiable deposits.

Prof. Burland's seminal contributions to understanding the mechanisms of ground movements from deep excavations and tunnelling are well known, especially his work with Prof. Peter Wroth when he was at BRE, including studies quantifying damage to masonry walls. As illustrated in this paper by **Standing, J.**, this early framework formed the basis of modern methodologies used worldwide for predicting tunnelling and excavation induced ground movements, their measurement and potential impact on surface structures. Moreover, new methods of monitoring have led to a number of breakthroughs for a better understanding of small-strain stiffness. Prof. Burland instigated comprehensive studies on building response to tunnelling, e.g., Jubilee Line Extension Project in London.

The paper by **Oberender, P. W.**, **Val, D. V.**, and **Puzrin, A. M.** draws inspiration from the work carried out by Prof. John Burland in stabilizing the Leaning Tower of Pisa and proposes a novel technique involving risk assessment for the Leaning Tower of St. Moritz. The study purports to make use of observation guided constitutive modelling to assess the landslide pressure. The approaches presented in this study can help to evaluate the structure-specific risk of reaching a state where the structure is either overstrained or loses its functionality.

Prof. Burland, in his Nash lecture in 1989, presented the concept of the Soil Mechanics Triangle whose corners were identified as Ground Profile, Soil Behaviour and Applied Mechanics. In the next paper written by **Fourie, A.**, the author applies the fundamentals of the triangle to the current state of practice regarding tailings dam management and illustrates how two recent tailings dam failures may have been avoided by adhering to the three pillars of good practice.

The final paper is by **Indraratna, B.**, **Israr, J.** and late **Vaughan, P. R.**, and it explains the scientific evolution of assessing the internal stability of granular soils through more accurate constriction based methods, and draws inspiration from the discussions between late Prof. Peter Vaughan (third Author) and Prof. Indraratna (first Author). The paper also includes an interesting case study for a permeable barrier design followed by the recommendations for their use by practising engineers. The paper also reflects Prof. Burland's fundamental contributions to the assessment of the stability of earth structures.

As a final note, it is noteworthy that Prof. Burland's contributions to Southeast Asia have been significant. His design and computational methodologies in Soil Mechanics and Foundation Engineering have been adopted in numerous mega-projects in Southeast Asia. Scores of students have learned from Prof. Burland at Imperial College over many years in both undergraduate and postgraduate degrees. Prof. Burland's contributions to various workshops and professional development seminars held in the region have helped many professionals and higher degree research students from Southeast Asia to enhance their skills.

The Guest Editors trust readers will find these contributions valuable and that the papers compiled here provide a lasting reflection of John Burland's contributions to our profession.

BIOGRAPHY OF GUEST EDITORS

Guest Editor:
Professor Buddhima Indraratna

Prof. Buddhima Indraratna is a Civil Engineering graduate from Imperial College, London, and obtained his PhD from the University of Alberta in 1987. He is currently a Distinguished Professor of Civil Engineering, and Director, Transport Research Centre, University of Technology Sydney (UTS), Australia and strives to enhance Australia's transport geotechnics through greater engagement with industry through national flagship projects. He was formerly, Founding Director, Centre for Geomechanics & Railway Engineering, University of Wollongong, Australia. Since 2018 he has been the Director of National Training Centre for Advanced Technologies in Rail Infrastructure (ITTC-Rail), funded by the Australian Research Council and Industry, and he was the pioneer of Australia's first High Speed Rail Testing Facility. Buddhima also holds several external positions as Distinguished Honorary Professor of Asian Institute of Technology, Thailand; Harbin Institute of Technology and Beijing Jiaotong University, China. He is the Chief Editor of Ground Improvement Journal, Institution of Civil Engineers, UK. His significant contributions to geotechnical and railway engineering have been acknowledged through many national and international awards, including the 1st Ralph Proctor Lecture and 4th Louis Menard Lecture of the ISSMGE, EH Davis Lecture of the AGS, and various pinnacle awards from IACMAG, Engineers Australia, and the Canadian Geomechanics Society.

Guest Editor:
Professor Andy Fourie

Prof. Andy Fourie has more than 30 years' experience in teaching, research and consulting in civil, geotechnical and offshore engineering. His research interests include analytical and numerical modeling, soil-structure interaction, rock mechanics, the behaviour of cemented and uncemented carbonate soils, soft soil engineering, tunnelling, and offshore foundations. He has attracted more than $5 million in competitive research funding and been associated with development projects attracting additional grants of more than $4 million. He is the author of several hundred refereed technical papers in geotechnical engineering and engineering mechanics, covering a diverse range of topics from theoretical mechanics to experimental applications. His research output includes a significant body of work on the engineering behaviour of seabed carbonate sediments.

GEOTECHNICAL ENGINEERING

Paper Contribution, Technical Notes, and Discussions

Geotechnical Engineering is the official journal of the Southeast Asian Geotechnical Society and the Association of Geotechnical Societies in Southeast Asia. It is published four times a year in March, June, September, and December and is free to members of the Society. Please visit our website at http://www.seags.ait.ac.th for the membership information.

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 for Soil Mechanics and Geotechnical 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. The standard ethical behavior of the authors, the editor, and his editorial panel, the reviewers, and the publishers is followed.

Before you submit an article, please review the guidelines stated herein for the manuscript preparation and submission procedures. The paper template is available upon request.

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 Chief Editor of Geotechnical Engineering Journal. Email: s-a-journal@ait.ac.th.

The guidelines for authors are as follows:

1. The manuscript including abstract of not more than 150 words and references must be typed in Times New Roman 9 on one side of A4 paper with a margin of 25 mm on each side. The abstract should be written clearly stating the purpose, the scope of work, and procedure adopted together with the major findings including a summary of the conclusions.
2. The paper title must not exceed 70 characters including spaces.
3. The maximum length of papers in the print format of the Journal is 12 two-column pages in single-spaced in Times New Roman 9 including figures and tables. A Journal page contains approximately 1,040 words. Authors can approximate manuscript length by counting the number of words on a typical manuscript page and multiplying that by the number of total pages (except for tables and figures). Add word-equivalents for figures and tables by estimating the portion of the journal page each will occupy when reduced to fit on a 160 mm x 240 mm journal page. A figure reduced to one-quarter of a page would be 260 word-equivalents. When reduced, the figure must be legible and its type size no smaller than 6 point font (after reduction).
4. Figures: Line art should be submitted in black ink or laser printed; halftones and color should be original glossy art. Figures should be submitted at the final width, i.e., 90 mm for one column and 185 mm for two columns. The font of the legends should be in Times New Roman and should use capital letters for the first letter of the first word only and use lower case for the rest of the words. Background screening and grids are not acceptable.
5. Each table must be typed on one side of a single sheet of paper.
6. All mathematics must be typewritten and special symbols identified. Letter symbols should be defined when they first appear.
7. The paper must have an introduction and end with a set of conclusions.
8. Practical applications should be included, if appropriate.
9. If experimental data and/or relations fitted to measurements are presented, the uncertainty of the results must be stated. The uncertainty must include both systematic (bias) errors and imprecisions.
10. Authors need not be Society members. Each author’s full name, Society membership grade (if applicable), present title and affiliation, and complete mailing address must appear as a footnote at the bottom of the first page of the paper.

11. Journal papers submitted are subject to peer review before acceptance for publication.
12. Each author must use SI (International System) units and units acceptable in SI. Other units may be given in parentheses or in an appendix.
13. A maximum of five keywords should be given.
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, p 191.

    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, pp 731-742.
15. Discussions on a published paper shall be made in the same format and submitted within six months of its appearance and closing discussion will be published within twelve months.

For additional information, please write to:

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