

**AUSTRALIAN
GEOMECHANICS
SOCIETY**
South Australian Chapter



July Meeting

2009 EH DAVIS MEMORIAL LECTURE

**RECENT ADVANCES IN THE APPLICATION OF
VERTICAL DRAINS AND VACUUM PRELOADING IN SOFT
SOIL STABILIZATION**

PROFESSOR BUDDHIMA INDRARATNA

**Professor, and Head of School Civil, Mining and Environmental
Engineering,**

Director, Centre for Geomechanics and Railway Engineering,

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SYNOPSIS

Much of the world's essential infrastructure is built along congested coastal belts composed of highly compressible and weak soils up to significant depths. Alluvial and marine soft clay deposits have very low bearing capacity and excessive settlement characteristics, with direct design and maintenance implications on tall structures, large commercial buildings, as well as port and transport infrastructure. Stabilizing such soft soils prior to construction is essential for both short and long term stability.

Pre-construction consolidation of soft formation soils by applying a surcharge load alone often takes too long. Moreover, attributed to the low permeability and high thickness of low-lying clay deposits, the required surcharge load to achieve more than 90% degree of consolidation can be excessively high over a prolonged period. A system of vertical drains combined with vacuum pressure and surcharge preloading has become an attractive ground improvement alternative in terms of both cost and effectiveness. This technique accelerates soil consolidation by promoting rapid radial flow, decreasing the excess pore pressure while increasing the effective stress.

Over the past 15 years, Prof. Buddhima Indraratna and his co-workers have developed numerous experimental, analytical and numerical approaches that simulate the mechanics of prefabricated vertical drains (PVD) and vacuum preloading including both two-dimensional and three-dimensional analyses and more comprehensive design methods. These recent techniques have been applied for various real-life projects in Australia and Southeast Asia. The new design concepts include the role of overlapping smear zones due to PVD-mandrel penetration, pore pressure prediction based on elliptical cavity expansion theory, and the rise and fall of pore pressure via PVD under cyclic loads. The recent

advances enable greater accuracy in the prediction of excess pore water pressure, lateral and vertical displacements of the stabilised ground.

This E.H. Davis Memorial Lecture presents an overview of the theoretical and practical developments and salient findings of soft ground improvement via PVD and vacuum preloading with applications to selected case histories in Australia, Thailand and China.

The International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE) Technical Committee on Ground Improvement, has proposed a classification system of ground improvement techniques according to the general nature of the soil, (frictional or cohesive) and the inclusion or exclusion of added material (<http://www.bbri.be/go/tc17>). This classification system has been detailed in the state of the art report on construction methods at the Alexandria ISSMGE Conference last October. On the basis of this classification system, selected case histories from around the world will be presented highlighting the initial concept and the relevant parameters for design, quality control and acceptance of the ground improvement works.

ABOUT THE SPEAKER

Professor Buddhima Indraratna is a Civil Engineering graduate from Imperial College, University of London, and completed his Masters degree in Soil Mechanics also at Imperial College and subsequently his PhD in Geotechnical Engineering at University of Alberta, Canada. Having worked in Geotechnical Industry for a number of years, he decided to join academia.

Currently he is Professor of Civil Engineering, and Head of School of Civil, Mining and Environmental Engineering at University of Wollongong. He is also the Director of the Centre for Geomechanics and Railway Engineering.

He was a recipient of Swedish Geotechnical Society award for Contributions to Ground Improvement in 1999, and in 2007 he received Robert Quigley award from the Canadian Geotechnical Society for his contribution to ground improvement for an article on soil consolidation published in the Canadian Geotechnical Journal. In 2008, Prof. Indraratna was awarded the Medal for Outstanding Contributions to the Region by the International Association for Computer Methods and Advances in Geomechanics. In 2009, he was the recipient of Business and Higher Education Round Table Award sponsored by the Australian Commonwealth for Outstanding R & D Contributions to Australian Rail Track Innovations.

Prof. Indraratna has been an active geotechnical consultant and a UNDP expert for various geotechnical projects in both Australia and overseas. He has been a Keynote Speaker and Special Guest Lecturer at over 25 international conferences. He has published over 300 articles in refereed journals and conferences, and the author of 4 books. He has supervised 35 PhD students in his career thus far. His research contributions to geotechnical engineering have been significant across a wide range of subject areas covering soft clay engineering, ground improvement, transportation geomechanics, embankments and dam engineering, waste materials utilisation and physical modelling of geotechnical processes.

He is a Fellow of the Institution of Engineers Australia, Fellow of American Society of Civil Engineers and a Fellow of the Geological Society, London.

Prof. Buddhima Indraratna is the 2009 E.H. Davis Memorial Lecturer of the Australian Geomechanics Society since its inaugural lecture in 1985. This is in recognition of his innovative and substantial contributions to Ground Improvement through theory and practice.

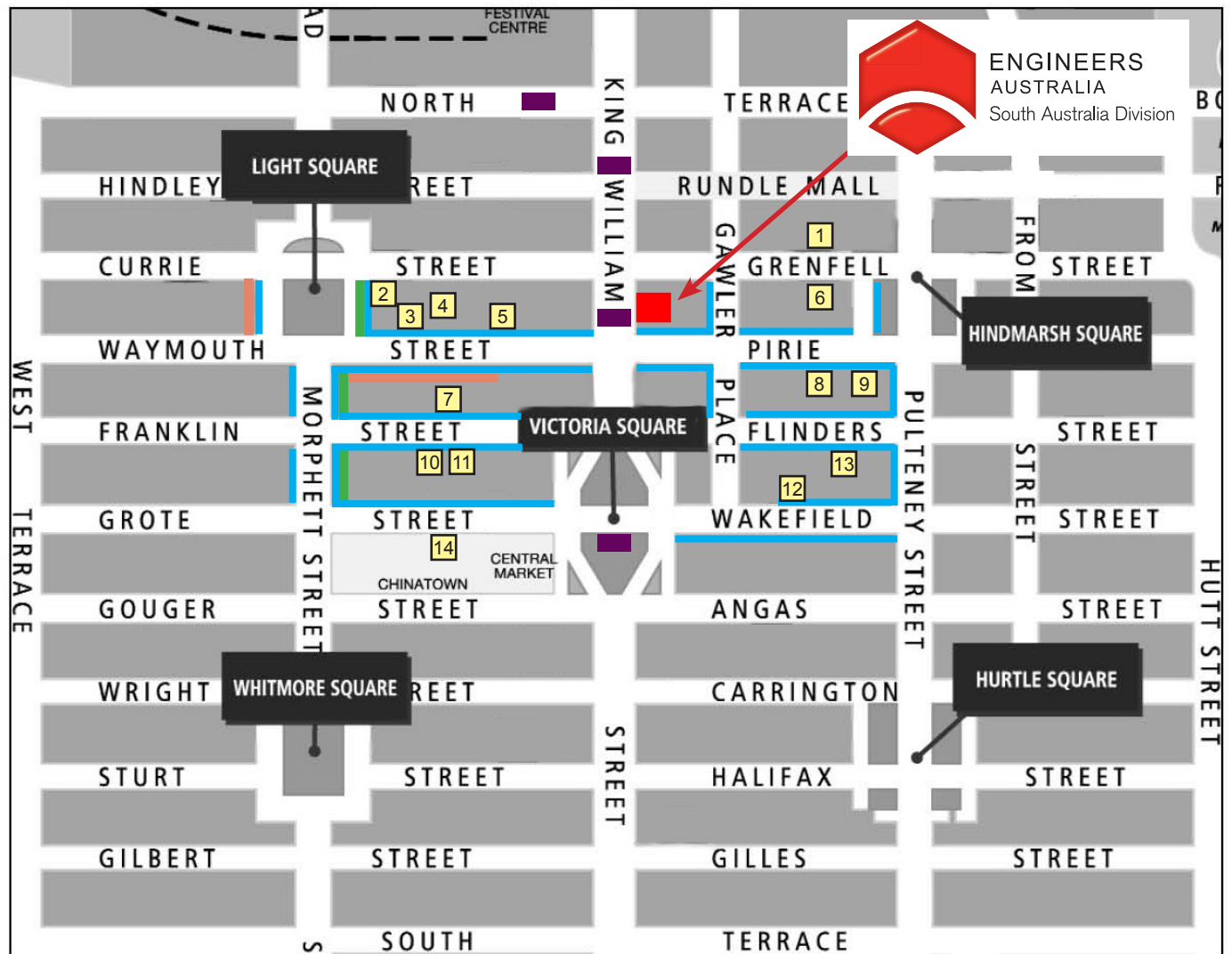
DATE: **Monday 26 July 2010**

TIME: **6:00 pm to 7.30 pm (light refreshments from 5:30 pm)**

VENUE: **Engineers Australia, Level 11, 108 King William Street,
Adelaide**

**** Note the change of address for Engineers Australia – refer to the map on the following page for further details**

Please check the AGS web site at <http://www.australiangeomechanics.org/sa> prior to attending for any late changes, or contact AGS Chairman Matthew Duthy on 8237 9607.



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South Australia Division

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