

Announcement: Award-winning papers in 2013

Papers published in *Géotechnique* are eligible for awards from the Institution of Civil Engineers. Papers from any of the ICE journals can be nominated for several awards. In addition, each journal has awards dedicated to their specific subject area.

On Friday 17 October 2014, ICE president Geoff French presented awards to the following papers published in *Géotechnique* in 2013. The editorial panel nominated their best papers and an awards committee chaired by Quentin Leiper allocated the awards.

The George Stephenson Medal, presented to the second best paper published in all the ICE journals, was awarded to Zhang *et al.* (2013).

ABSTRACT

A new formula is proposed for the end-bearing capacity of piles penetrating into crushable soils. The formula is based on a breakage mechanics model that accounts for the evolution of the grain size distribution (GSD) due to grain crushing with only physically meaningful parameters. The model is integrated using the finite-element method to study the penetration problem. Predictions of GSDs surrounding piles and pile end-bearing capacities are validated against experiments. Next, a parametric study is carried out to quantify the effects of grain crushing on the bearing capacity, and then to establish the formula. The predictive capability of the new formula is highlighted against predictions by previous formulae, which highlights its superior origins.



Itai Einav receives the George Stephenson Medal from ICE President Geoff French

The Geotechnical Research Medal, presented for the best paper on geotechnical research, was awarded to Alonso *et al.* (2013).

ABSTRACT

The paper explores the behaviour of compacted soils throughout the (dry density–water content) compaction plane by means of a conceptual framework that incorporates microstructural information. The engineering properties of compacted soils are described by an initial state in terms of a yielding stress, soil suction and a microstructural state variable. Microstructure is defined by the ratio of microvoid volume to total void volume. The pattern of variation of the microstructural parameter within the compaction plane has been determined, for some compacted soils, by analysing mercury intrusion porosimetry data. The microstructure of wet and dry compaction conditions can then be quantified. To ensure consistency, the framework is cast in the form of a constitutive model defined in terms of an effective suction and a constitutive stress that incorporate the microstructural variable. The model is shown to be consistent with a number of experimental observations and, in particular, it explains the intrinsic collapse potential of compacted soils. It predicts, for a common initial suction, a higher collapse potential for dry of optimum conditions than for wet compaction. It also predicts in a natural manner the observed evolution of soil compressibility during drained or undrained loading. Model capabilities are illustrated by application to a testing programme on statically compacted samples of low-plasticity silty clay. The compression behaviour of samples compacted wet and dry of optimum and the variation of collapse strains with confining stress have been successfully reproduced by the model.

The David Hislop Award, presented to the best paper published on heavy marine design and construction with particular reference to offshore engineering, was awarded to Lee *et al.* (2013).



ICE President Geoff French with Geotechnical Research Medal winners Eduardo Alonso, Antonio Gens and Nuriya Pinyol

ABSTRACT

When a jack-up spudcan foundation is installed on seabeds consisting of a sand layer overlying soft clay, the potential for ‘punch-through’ failure exists. This happens as a result of an abrupt reduction in bearing resistance when the foundation punches a block of sand into the underlying soft clay in an uncontrolled manner. This paper details an extensive series of 30 tests of flat circular and spudcan foundations continuously penetrated through samples of sand overlying clay, and performed under relevant stress conditions using a drum centrifuge. The large testing area of the drum centrifuge was used advantageously to produce test results that could be compared directly with tests covering a sand thickness over foundation diameter of 0.21 to 1.12. Results from retrospective finite-element analysis of the experiments are also described, with back-calculated values of the stress-level-dependent friction and dilation angles in the sand during peak penetration resistance shown to fit correlations in the literature. The back-analysis showed that larger values of peak resistance gave lower friction and dilation angles, which is consistent with gradual suppression of dilatancy under high confining stress. When compared with published results from visualisation experiments, the finite-element analysis showed a similar failure mechanism during peak resistance, with a frustum of sand forced into the underlying clay at an angle reflecting the dilation in the sand.

The T K Hsieh Award, presented to the best paper published in the field of structural and soil vibration caused by mechanical plant, waves or seismic effect, was awarded to Montoya *et al.* (2013).

ABSTRACT

Microbial-induced calcite precipitation (MICP), a novel bio-mediated ground improvement method, was explored to mitigate liquefaction-prone soils. Geotechnical centrifuge tests were used to evaluate cementation integrity and the response of MICP cemented sands to dynamic loading. The cementation integrity testing reveals a change in behaviour from ‘soil like’ to ‘rock like’, with an increase in treatment level. Results from dynamic testing demonstrate a clear increase in resistance to liquefaction of MICP-treated sands compared to untreated loose sand. The MICP sands were treated to varying levels of cementation (light, moderate and heavy cementation levels) and assessed using non-destructive shear wave velocity measurements. The centrifuge models



ICE President Geoff French with David Hislop Award winners Kok Kuen Lee and Mark Randolph



Brina Montoya is presented with the T K Hsieh Award by ICE President Geoff French

were all subjected to ground motions consisting of sine waves with increasing amplitudes. Accelerations, pore pressures and settlements were measured in the soil during shaking, and the changes in soil behaviour and post-shaking shear wave velocity for soils prepared to different cementation levels are discussed. Increased resistance to liquefaction was demonstrated with a decrease in excess pore pressure ratios in the MICP-treated models, as well as in reduced post-shaking settlements; however, surface accelerations were amplified at heavy levels of cementation. A trade-off between improving liquefaction resistance and minimising undesirable higher surface accelerations needs to be considered when designing the soil improvement level.

REFERENCES

- Alonso, E. E., Pinyol, N. M. & Gens, A. (2013). Compacted soil behaviour: initial state, structure and constitutive modelling. *Géotechnique* **63**, No. 6, 463–478, <http://dx.doi.org/10.1680/geot.11.P.134>.
- Lee, K. K., Cassidy, M. J. & Randolph, M. F. (2013). Bearing capacity on sand overlying clay soils: experimental and finite-element investigation of potential punch-through failure. *Géotechnique* **63**, No. 15, 1271–1284, <http://dx.doi.org/10.1680/geot.12.P.175>.
- Montoya, B. M., DeJong, J. T. & Boulanger, R. W. (2013). Dynamic response of liquefiable sand improved by microbial-induced calcite precipitation. *Géotechnique* **63**, No. 4, 302–312, <http://dx.doi.org/10.1680/geot.SIP13.P.019>.
- Zhang, C., Nguyen, G. D. & Einav, I. (2013). The end-bearing capacity of piles penetrating into crushable soils. *Géotechnique* **63**, No. 5, 341–354, <http://dx.doi.org/10.1680/geot.11.P.117>.