[http://dx.doi.org/10.1680/geot.2012.62.1.93]

Announcement: Award-winning papers in 2010

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 Monday 24 October 2011, ICE president Peter Hansford presented awards to the following papers published in *Géotechnique* in 2010. The editorial panel nominated their best papers and an awards committee chaired by Barry Clarke allocated the awards.

The Geotechnical Research Medal, presented for the best paper on geotechnical research, was awarded to: Wang, J. & Gutierrez, M. (2010). Discrete element simulations of direct shear specimen scale effects. *Géotechnique* **60**, No. 5, 395–409, http://dx.doi.org/10.1680/geot.2010.60.5.395.

Marte Gutierrez and Jianfeng Wang, winners of the Geotechnical Research Medal, with ICE President Peter Hansford

ABSTRACT

This paper presents a study of the micromechanics of granular materials as affected by the direct shear test scale using the discrete element method (DEM). Parametric studies were conducted to investigate the effects of specimen length and height scales (in relation to the particle size) on the bulk material shear strength and shear banding behaviour in the direct shear test. A mesh-free strain calculation method previously developed by the authors was used to capture and visualise the evolution of strain localisation inside the direct shear box. Simulation results show that the maximum shear strength measured at the model boundaries increases with decreasing specimen length scale and increasing specimen height scale. Micromechanics-based analysis indicates that the local and global aspects of fabric change and failure are the major mechanisms responsible for the specimen scale effect. Global failure along the primary shear band prevails when the specimen length scale and length to height aspect ratio are small, while progressive failure becomes more likely when the specimen length scale and aspect ratio become larger. Further quantifications of the specimen scale effects on the macroscopic behaviour of granular materials rely on the fundamental understanding of quantitative relationships between material fabric, anisotropy and bulk strength.

The Overseas Prize, presented for the best paper on a subject connected with works carried out outside the British Isles, was awarded to: Hossain, M. S. & Randolph, M. F. (2010). Deep-penetrating spudcan foundations on layered clays: numerical analysis. *Géotechnique* **60**, No. 3, 171–184, http://dx.doi.org/10.1680/geot.8.P.040.

ABSTRACT

This paper presents results of large deformation finite element (LDFE) analyses that investigate the penetration response of deep-penetrating spudcan foundations in stratified soil comprising a strong clay layer overlying weaker clay. Such strength profiles give rise to potential punch-through failure, with a local maximum penetration resistance followed by some reduction. The paper is a companion paper to one that presents results from centrifuge model tests of the same problem, with the overall aim being to investigate the potential for punch-through failure and its severity, as a basis for improving design methods for evaluating spudcan penetration. The LDFE analyses have simulated continuous penetration of smooth and rough spudcan foundations from the sea-bed surface. A detailed parametric study has been undertaken, exploring the relevant range of layer thickness (relative to the spudcan diameter), strength ratios and spudcan base roughness. The results have been validated against previously published results and the centrifuge test data presented in a companion paper. Excellent agreement was obtained between the results from LDFE analyses and centrifuge tests. As the ratio of the shear strength of the bottom layer to that of the top layer decreased, upwards soil flow around the spudcan shoulder became less pronounced and the failure mechanism was dominated by a steep-sided plug of soil from the top layer being forced deep into the lower layer. The potential for severe punch-through was demonstrated by a significant reduction in the resistance profile as the spudcan approached the interface between the two layers. A preliminary design chart is proposed to estimate the cavity depth above the penetrating spudcan, which was significantly greater than that for a single layer clay. The penetration responses have been presented in terms of profiles of normalised net bearing pressure for a range of layer geometries and soil properties. Potential punch-through occurred for all cases where the strength ratio was less than or equal to 0·6, with the reduction in resistance being greater the lower the strength ratio of the underlying layer to the upper layer, and the thicker the upper layer, but reducing as the strength gradient in the lower layer increased. The current approach suggested in offshore design guidelines is shown to underestimate the penetration resistance significantly, in most cases, and give poor estimates of the likelihood and severity of spudcan punch-through.

A Telford Premium prize was awarded to: Ni, Q., Hird, C. C. & Guymer, I. (2010). Physical modelling of pile penetration in clay using transparent soil and particle image velocimetry. *Géotechnique* **60**, No. 2, 121–132, http://dx.doi.org/10.1680/geot.8.P.052.

ABSTRACT

A small-scale physical modelling method was developed to study the movement of clay during pile installation. The clay was simulated using a mixture of amorphous silica and mineral oil, which becomes almost transparent when the refractive indices of the oil and the silica are well matched. After adding reflective particles and consolidating the mixture in a transparent container, cylindrical model piles were driven vertically at the centre. A vertical section aligned with the pile centreline was illuminated by a laser light sheet, and a sequence of digital images was recorded. These were analysed using particle image velocimetry, and the complete displacement distribution during the pile installation was obtained. Notwithstanding some discrepancies at shallow depths, the observed displacements generally showed fairly good agreement with the theoretical predictions of the shallow strain path method (SSPM) once the effect of some soil trapped beneath the flat pile tip was taken into account. Normalisation of the horizontal and vertical components of movement employing both the pile length and radius, based on SSPM theory, was shown to be valid. The normalised vertical displacement contours were similar to those published by previous researchers. The results of this study could be used to assess the impact of disturbance due to pile installation on, for example, buried services or archaeology.