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Géotechnique, Vol. L, No. 1, February 2000

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The February 2000 issue of *Géotechnique* contains a broad range of high-quality international papers. Although the papers are mainly by academics, they all make important practical contributions. To extract this valuable information, the practising engineer must be prepared to study the papers.

Two excellent papers study consolidation in relation to waste disposal problems (tailings waste and gassy sludge) where storage volumes are critical. A suite of papers on granular media investigate the influence of fines content, the contribution of particle breakage to strength, the effects of test control on mechanical behaviour and the physics of particle systems.

Other papers examine the clay-interface shear resistance, providing further insight into the development of skin friction on piles, while another describes a laboratory investigation of smear during the installation of vertical drains and provides useful information on factors that control its severity.

Intergranular state variables and stress–strain behaviour of silty sands

S. Thevanayagam and S. Mohan

The authors present an in-depth reanalysis of critical-state soil mechanics concepts extended to silty sand. New sets of state parameters are introduced to characterize the behaviour of silty sand and experimental data support the formulation of a new framework. Although largely theoretical and experimental, the paper provides practical 'design' classification charts as a function of fines content and defines the dominant particle size of a silty sand that controls its engineering response.

Soil formation from tailings: comparison of predictions and field measurements

N. S. Consoli and G. C. Sills

This important and practical issue has been studied by combining the analyses associated with the simultaneous processes of sedimentation and consolidation. Validation of the methodology was demonstrated against a real problem. Reliable modelling of consolidation was the key to success since the consolidation process achieved a large part of the final storage.

A finite strain theory for gassy sludge

B. G. H. M. Wichman

The paper investigates an important problem affecting the disposal of contaminated sludge and the required space for disposal. The consolidation of low-density gassy material is a major consideration. Finite strain theory for saturated soils was extended to the case of self-weight consolidation of a gassy soft soil. Gas bubbles substantially retard consolidation.

Numerical simulations of deviatoric shear deformation of granular media

C. Thornton

Numerical simulations have enabled the author to examine a number of internal variables that improve the understanding of the physics of particle systems. Interesting results are presented, including the role of interparticle friction in relation to sliding contacts, the stability of the system and the chains of particles carrying the large force transmission paths.

Clay-interface shear resistance

L. J. L. Lemos and P. R. Vaughan

The paper essentially extends earlier work undertaken by the same authors and examines the effects on various interfaces of residual strength. The results provide considerable insight into the generation of residual strength. The authors have shown that for clays with high clay content, ultimate interface shear resistance closely resembles soil-on-soil residual strength. Except for very smooth and polished interfaces, residual strength is independent of interface roughness. Ultimate strength is achieved at low shear displacements. In clays with a lower clay content, in which soil-on-soil residual strength would be turbulent or transitional, the interface promotes sliding.

Energy aspects of particle breakage in drained shear of sands
Tzou-Shin Ueng and Tse-Jen Chen

The authors have extended Rowe's stress dilatancy relationship to include particle breakage. A number of triaxial compression tests have been undertaken to demonstrate the importance of crushable grains at high and low confining pressures. It was found that the frictional strength increased with confining stresses due to energy consumed in particle breakage. The effect of initial relative density was not significant. This is a useful contribution to the understanding of the strength of material comprising crushable particles.

Mechanical modelling of drained creep triaxial tests on loose sand
C. Di Prisco, S. Imposima and I. Vardoulakis

The behaviour of loose sand has been studied in stepped triaxial tests. The results are interesting and show that the mechanical behaviour is dependent on the control employed during the test. Instability takes place during load-controlled tests rather than during constant rate of strain tests. The behaviour under stepped loading is a result of stabilizing volumetric strain hardening and destabilizing frictional strain softening, the latter being suppressed in strain-controlled tests.

Distribution of earth pressure on a retaining wall
Y.-Z. Wang

The author provides equations for estimating unit earth pressure acting on a retaining wall. It considers the equilibrium of forces acting on a wedge of soil irrespective of wall movement and the active failure state. In this regard, it more closely resembles the analysis of a 'slice' of a slope.

Model study of seepage in smear zones around vertical drains in layered soil
C. C. Hird and V. J. Moseley

The paper presents a series of small-scale tests to investigate the effect of smear around vertical drains mainly in layered soils. This is a useful insight into the extent of smear but, as the authors state, the results cannot be expected to represent actual field installation until scaling relationships have been established. Other factors will also influence results, for example time, and the roughness of a mandrel owing to the effects of smear were shown to be substantial and concentrated within a zone of 1.2 rw. The severity of the smear increased as the clay layer and sand thickness reduced or as the installation speed reduced but it did not depend on the angle of the mandrel tip.

Influence of curing under stress on the triaxial response of cemented soils (technical note)
N. C. Consoli, G. V. Rotta and R. D. M. Prietto

The authors present results of triaxial tests on artificially cemented weathered sandstone with specimens prepared with and without a confining stress during the curing stage. The strength and stiffness characteristics from both sets of results illustrate the influence of stress during the cementing process. The importance of taking samples at differing depths (geostatic stresses) and applying appropriate confining stresses are discussed.

Géotechnique, Vol. L, No. 2, April 2000
Mike Hicks, BSc, PhD, CEng, MICE, University of Manchester

Anisotropic stiffness parameters and their measurement in a stiff natural clay
M. L. Lings, D. S. Pennington and D. F. T. Nash

This detailed paper compares various cross-anisotropic elastic formulations and develops a common framework. Values for five independent parameters are derived from results of drained stress path excursion tests on Gault Clay; these compare favourably with those derived by way of the three-parameter formulation of Graham and Houlsby.

Comparison of measured and calculated temporary-prop loads at Canada Water Station
W. Powrie and M. Batten

Prop loads (including temperature effects) and wall movements measured during the construction of London Underground's Canada Water Station are presented. These compare favourably with limit equilibrium calculations and finite-element computations using an established computer package.

Drained probing triaxial tests on a weakly bonded artificial soil
V. Malandraki and D. Toll

Results are presented for drained probing triaxial tests on a weakly bonded artificial soil. These show that the yield loci for bonded soils are not unique, but depend on stress path direction; that is, bond strength is greater for stress paths involving increase, rather than decrease, in effective pressure.

A kinematic hardening constitutive model for natural clays with loss of structure
M. Rouainia and D. Muir Wood

The authors develop a kinematic hardening model based on three yield surfaces: a reference

surface (compared to Cam clay) for modelling the reconstituted soil; a bubble surface, which defines the elastic zone; and a structure or bounding surface, which models material bonding. Numerical simulations compare favourably with experimental data for a low-sensitivity Swedish clay.

Numerical modelling of full-scale tests on drystone masonry retaining walls

R. M. Harkness, W. Powrie, X. Zhang, K. C. Brady and M. P. O'Reilly

An established discrete element code is used to model the behaviour of four, geometrically different, drystone masonry retaining walls; the computed results (which have been extensively illustrated) are in broad agreement with results of field trials carried out by Burgoyne in 1834.

Fall-cone penetration and water content relationship of clays

T. W. Feng

The paper focuses on the use of the fall-cone penetration test for measuring plastic limit. Sample disturbance during preparation is reduced by using a specimen ring rather than a cup. Experimental data show a linear, logarithmic, relationship between depth of penetration and water content (compared with water content/log depth response, which is non-linear) and fewer data points are then needed to define response.

Estimation of *in situ* stresses using anisotropic elasticity and suction measurements

I. G. Doran, V. Sivakumar, J. Graham and A. Johnson

An existing three-parameter, cross-anisotropic, elastic model is used to simulate changes in mean effective stress and pore pressure during 'perfect sampling' of overconsolidated clays. Using elastic parameters derived from CI-triaxial tests, suctions in unloaded laboratory specimens, and effective overburden pressure, the proposed method is used to predict K_0. Good agreement between predicted and measured horizontal *in situ* effective stresses for two clays is shown.