

SESSION 18: STRESS-STRAIN MODELS

Papers:

THE APPLICATION OF A CRITICAL STATE SOIL MODEL OF CYCLIC TRIAXIAL TESTS
J.P. Carter, J.R. Brooker and C.P. Wroth, Vol 2, 121-126

ELASTIC BEHAVIOUR OF NORMALLY CONSOLIDATED CLAY
S. Ohmaki, Vol 2, 127-132

THE NATURE OF ANISOTROPY IN SOFT CLAYS
L.D. Wesley, Vol 1, 219-224

Paper by J.P. Carter, J.R. Brooker and C.P. Wroth

Dr R.H.G. Parry commented that the concept of the shrinking yield surface during unloading was not new. It was not related to cyclic loading but to the fact that during unloading the soil became increasingly over-consolidated. He asked if there was anything in the model that allowed for energy dissipation below the yield surface, and commented in general terms on the ultimate strength under cyclic loading, and on the influence of anisotropy on shear strength.

Dr Carter agreed that during unloading real soil did not exhibit purely elastic behaviour. However, the model was an attempt to describe real soil behaviour in a simple manner. Regarding the build up in pore pressure, the idea of the model was to simulate the increase in pore pressure with cyclic loading of real soils. Pore pressure dissipation was not allowed during unloading.

Prof. B. Ladanyi asked whether the authors had tried to analyse the cyclic test results in terms of a cumulative plastic deviatoric strain, which might be a constant at failure and could eventually be used as an alternative failure criterion for cyclic loading under undrained conditions. Dr Carter replied that they had not considered this type of parameter. Dr M.J. Pender added that considering cyclic deterioration of the soil in terms of a single parameter, such as plastic deviation strain, might work for stress controlled loading, but would not work for the strain controlled cyclic loading that the authors used to check out their model.

Paper by L.D. Wesley

Mr P.A. McAnally commented that in triaxial and plane strain conditions, the minor principal stress would decrease during undrained loading if the A coefficient was greater than zero. Hence the value of E_x should be that for extension strain. It appeared from the paper that E_x was measured for compression strain and this

could explain, at least in part, the discrepancy between predicted and observed pore pressures.

Dr Wesley replied that in Figs 4 and 5 in the paper, the strain was measured in the direction of the major principal stress. However, in Fig 8 this did not apply since the stress paths were not related to strains.

Prof E.H. Davis agreed that the shear strength on any plane was not only dependent on the inclination of the plane but also on the direction of shearing. In the pressure versus shear stress plane the isotropic failure criterion was represented by a circle. If the soil was anisotropic the failure surface became an ellipse, centred on the origin. If the direction of shearing was allowed for then the failure ellipse was no longer centred on the origin. He further commented that the effect of anisotropy on bearing capacity was not large. Increasing anisotropy caused a slight decrease in the bearing capacity.

Prof I.B. Donald commented that anisotropy could be structurally induced or stress induced into a soil. The presence of structural anisotropy could be determined from shear tests on orientated samples. Stress induced anisotropy depended on the stress path followed. It was theoretically predictable, for example, from a triaxial test. He also commented that the degree of anisotropy was known to be related to the plasticity index of the soil. Dr Wesley replied that great care had to be exercised when determining the degree of anisotropy from triaxial compression and extension tests. The different stress paths followed could affect the results, and anisotropic behaviour could be implied for an isotropic material.

Dr I.J. Smalley asked if Dr Wesley would care to say whether anisotropy due to very extensive loading or anisotropy produced in relatively unstressed clay due to sedimentation would be more effective in a practical sense. Dr Wesley replied that anisotropy in normally consolidated clays seemed to be a stress-induced phenomenon. Over-consolidated clays (eg, London clay) seemed to have a bedding anisotropy.