AIN SHAMS UNIVERSITY

Faculty of Engineering

AN EFFECTIVE STRESS CONSTITUTIVE MODEL FOR SOFT CLAY

By

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STATEMENT

This dissertation is submitted to Ain Shams University for the degree of M.Sc. in Civil Engineering.

The work included in this thesis was carried out by the author in the Department of Structural Engineering, Ain Shams University, From April 1996 to August 1997.

No parts of this thesis has been submitted for a degree of a qualification at any other university or institution.

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Abstract

Constitutive equations which model accurately the soil behaviour are essential if reliable numerical predictions of soil performance are to be achieved for practical geotechnical problems. One of these models is the Modified Cam-Clay model which is mainly used to simulate the behaviour of normally to lightly over-consolidated clay. The main aim of this research is to get better prediction for soft clay deformations using this comprehensive elasto-plastic idealization which is based on the critical state concept. This thesis includes a brief discussion of the basics of the model and its implementation into a finite element code. A new numerical scheme based on the pore pressure measurements is proposed to perform an effective stress analysis and to simulate the dissipation of pore water pressure with time. The new scheme is incorporated in a finite element code.

In order to check the validity of the model, to verify the numerical scheme and to test the results of the program, drained and consolidated undrained triaxial tests are simulated numerically. Finally, the program are utilized to simulate an actual geotechnical problem. An embankment case history from Alberta, Canada, is simulated and analyzed, the numerical results are compared with the field measurements and good agreement is achieved.

Keywords : Constitutive models, critical state concept, Modified Cam-Clay, effective stress analysis, pore water pressure. finite element analysis, field measurements, deformation and earth embankments.

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