NUMERICAL IMPLEMENTATION OF A CONSTITUTIVE MODEL FOR SOIL CREEP

This thesis was submitted to the Department of Civil Engineering of the University of Moratuwa in partial fulfillment of the requirements for the Degree of Master of Science

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DECLARATION

The work included in this thesis in part or whole has not been submitted for any other academic qualification at any institute.

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ABSTRACT

Multi-dimensional (2-D and 3-D) soil creep models are generalized from Bjerrum's 1-D creep model (Bjerrum, 1967), which is based on field test data. This model is based on an expression for creep strain rate, and was later modified for transient loading conditions. This differential form of 1-D creep model is extended to multi-dimensional (2-D and 3-D) state of stress and strain by incorporating concepts of visco-plasticity. The devised 2-D and 3-D creep models take into account both volumetric creep strain and deviatoric creep strain, and creep deformation of the soil is defined by several material parameters. A non-linear, time incrementing finite element program, along with iterative corrections within each time step, had been already developed for research purposes by Dr. U. G. A. Puswewala (Puswewala and Rajapakse, 1992). Certain modifications were done in the latter main program to incorporate the present model as an element subroutine for plane strain condition. The numerical model will enable to check the sensitivity of model parameters on predicted results as well as the time-dependent solution of complicated foundation-soil interaction problems involving creep of soil. Numerical analyses are conducted on three different soil-structure interaction configurations using published experimental data and parametric studies are conducted to evaluate the sensitivity of different input parameters of the model. The verified program will be an important resource tool for estimating settlements in structures founded on soils exhibiting creep.

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CONTENTS

5.0 NUMERICAL ANALYSIS AND DISCUSSION

6.0 SUMMARY AND CONCLUSIONS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES