# TABLE OF CONTENTS

## 1 Introduction
1.1 On the use of three different models ........................................... 1 - 1
1.2 Warnings .................................................................................. 1 - 2
1.3 Contents .................................................................................. 1 - 3

## 2 Preliminaries on material modelling
2.1 General definitions of stress and strain ...................................... 2 - 1
2.2 Elastic strains .......................................................................... 2 - 3
2.3 Undrained analysis with effective parameters............................ 2 - 5
2.4 Undrained analysis with undrained parameters.......................... 2 - 8
2.5 The initial pre-consolidation stress in advanced models ............ 2 - 8
2.6 On the initial stresses ................................................................ 2 - 10

## 3 The Mohr-Coulomb model (perfect-plasticity)
3.1 Elastic perfectly-plastic behaviour ............................................ 3 - 1
3.2 Formulation of the Mohr-Coulomb model .................................. 3 - 2
3.3 Basic parameters of the Mohr-Coulomb model............................. 3 - 4
3.4 Advanced parameters of the Mohr-Coulumb model...................... 3 - 8

## 4 The Hardening-Soil model (isotropic hardening)
4.1 Hyperbolic relationship for standard drained triaxial tests.......... 4 - 2
4.2 Approximation of hyperbola by the Hardening-Soil model .......... 4 - 3
4.3 Plastic volumetric strain for triaxial states of stress .................... 4 - 5
4.4 Parameters of the Hardening-Soil model .................................... 4 - 6
4.5 On the cap yield surface in the Hardening-Soil model ................. 4 - 11

## 5 Soft-Soil-Creep model (time dependent behaviour)
5.1 Introduction ............................................................................ 5 - 1
5.2 Basics of one-dimensional creep ............................................. 5 - 2
5.3 On the variables $\tau$ and $\varepsilon$ .............................................. 5 - 4
5.4 Differential law for 1D-creep .................................................... 5 - 6
5.5 Three-dimensional-model ........................................................ 5 - 8
5.6 Formulation of elastic 3D-strains ............................................. 5 - 10
5.7 Review of model parameters ................................................... 5 - 11
5.8 Validation of the 3D-model ...................................................... 5 - 14

## 6 The Soft-Soil model
6.1 Isotropic states of stress and strain ($\sigma_1' = \sigma_2' = \sigma_3'$) .......... 6 - 1
6.2 Yield function for triaxial stress state ($\sigma_3' = \sigma_1'$) .................. 6 - 3
6.3 Parameters in the Soft-Soil model ............................................ 6 – 5
7 Applications of advanced soil models
7.1 HS model: response in drained and undrained triaxial tests
7.2 Application of the Hardening-Soil model on real soil tests
7.3 SSC model: response in one-dimensional compression test
7.4 SSC model: undrained triaxial tests at different loading rates
7.5 SS model: response in isotropic compression test
7.6 Submerged construction of an excavation with HS model
7.7 Road embankment construction with the SSC model

8 References

A Appendix A - Symbols
8 REFERENCES


