FORMULATION OF GENERALIZED CAM CLAY MODEL

Tomáš Janda, Michal Šejnoha*

In this contribution, a generalized Cam clay model for cohesive soil materials is introduced. A new formulation not only suppresses evolution of excessive failure stresses and dilatancy rate, but also allows for the reduction of non-realistic softening behavior of overconsolidated soils predicted when adopting the formulation of classical Cam clay model. More realistic response of the soil is achieved by introducing a new yield function in the dilatation (supercritical or dry) domain, i.e. for OCR > 2. Further, the dependency of the yield function on the Lode angle is adopted and non-associated flow rule is assumed. Finally, the reduction of hardening modulus is shown in comparison to the classical Cam clay model formulation.

Key words : *Cam clay model, hardening, softening, preconsolidation pressure, overconsolidation ratio*

1. Introduction

Development of reliable constitutive models capable of describing most of the important characteristics of real soil behavior has been the subject of research for many decades. At present the literature offers a vast number of constitutive models usually targeted to specific soil and loading conditions. Apart from almost classical constitutive models such as the Mohr-Coulomb, Drucker-Prager [2] plasticity models, there exists a variety of more advanced models able to predict most of the fundamental aspects of real soil behavior.

Since the work of Hvorslev [5] on remoulded saturated cohesive soils at failure followed for several decades by extensive experimental investigation on both clays and sands or a mixture of the two it has been argued that a general model should include essential features of both the frictional type of failure models and the critical state models originated from the work of Roscoe, et al. [18] and further developed into modified Cam clay model proposed by Roscoe and Burland [17]. While for sands, when represented by the Mohr-Coulomb type of failure enhanced by introduction of smoothed yield surface in the deviatoric plane and by hardening or softening features, the lack of the cap yield surface does not bring any major disadvantages, the modification to the supercritical part of the Cam clay model is crucial for receiving realistic predictions of the behavior of soils and clays in particular.

Rapid evolution of 'advanced' types of constitutive models was further promoted by increasing computational power and introduction of the finite element method for simulation of complex structures under variety of loading conditions. Among others, the constitutive models proposed by Zinkiewicz&Nailor [20], Lade and Kim&Lade [10, 9, 11], Matsuoka&Nakai [14], Van Eekelen [3] deserve attention. Further advancement to the description of the real soil behavior has been provided by the introduction of the concept of bounding

* Ing. T. Janda, doc. Ing. M Šejnoha, Ph.D., CTU in Prague, Faculty of Civil Engineering, Department of Structural Mechanics, Thákurova 7, 166 29 Praha 6