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Constitutive Models for Peat– A Review

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ABSTRACT

This paper presents a review of the main constitutive models for peat and other highly organic soils having extremely high water content. At present, predictions of the geomechanical behaviour of such soils for design practice are mostly based on constitutive theories developed for fine-grained mineral soils. Conventional concepts of primary consolidation and secondary compression as applied to peat are explained using the two-level structure assumption of micropores and macropores [1]. As background, the historical development of consolidation hypotheses A & B [2] regarding the concept of primary consolidation and secondary compression is reviewed for both mineral and organic soils. It is understood that models adopting hypothesis A are represented by the C_α/C_c concept developed by Mesri and his co-workers [3, 4], whereas models adopting hypothesis B consider that creep occurs during both primary and secondary compression stages. Based on microscopic examinations and in-situ testing, it is generally accepted that hypothesis B is more suitable for peat. The micro-mechanical rheological model proposed by Berry and Poskitt [5] and the isotache-compression model developed by den Haan [6] reported good agreement with experimental laboratory data for fibrous and amorphous peats. Attention is given to the structural anisotropy of peat soils, present on account of its fibrous nature, in the constitutive frameworks. The effect of structural degradation caused by the decomposition of peat is a novel feature of Karunawardena's [7] elastic visco-plastic model. Micro- and macro- mechanical models considering the dramatic reduction in the coefficient of permeability and high compressibility of peat occurring under loading are mostly based on empirical laws rather than experimental data. Future research outlooks are discussed, including recommendations to concentrate efforts on developing and improving thermodynamically consistent approaches to model structural anisotropy and the large deformation experienced by peat and other highly organic materials under loading.

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