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黄河下游堤防非饱和土边坡稳定性分析

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摘要 利用应力应变控制式非饱和土三轴仪进行了室内非饱和土的渗透试验和强度试验, 并得出了非饱和土的渗透参数和强度参数。针对黄河下游堤防这一典型的非饱和土边坡, 采用有限单元法系统地分析了堤防非饱和土边坡在降雨和洪水作用下的非饱和渗流场特征; 在此基础上应用非饱和土坡的刚体极限平衡理论中的普通条分法对堤防边坡稳定性受非饱和渗流场变化影响的大小进行了分析与计算。结果表明, 对黄河下游堤防的非饱和土边坡在降雨和洪水条件下的分析研究具有实际意义。

关键词 [土力学](#); [非饱和土边坡](#); [渗透性](#); [强度](#); [极限平衡](#)

分类号

STABILITY ANALYSIS OF UNSATURATED SOIL SLOPE OF LEVEE FOR THE YELLOW RIVER LOWER REACHES

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Abstract

The triaxial test instrument for unsaturated soil controlled by stress and strain is used to measure the substrate suction and volumetric water content of unsaturated soil. The permeability coefficient of the unsaturated soil can be got from the concrete form of the Mualem equation which is deduced based on the relation between the soil-water characteristic curve equation and the permeability. The cohesive strength, internal friction angle and the internal friction angle changing with suction can be also got from the triaxial test on unsaturated soil in the laboratory. With the finite element method, the characteristics of the seepage field in the Yellow River lower reaches which is a representative unsaturated slope under the rainfall and flood condition are analyzed systematically. Also the safety factors influenced by the seepage field of unsaturated soils under the rainfall and flood are analyzed with the method of GLE which is a kind of limit equilibrium method not considering the effect of scour. The factors including the intensity of the rainfall, the permeability coefficient and the duration of rainfall and flood and the relationship between them are significant for the computation. By analyzing, the corporate influences of rainfall and flood infiltration on the safety of slope stability are analyzed; and the results show that the effect of rainfall and flood is complex and important for the safety of the river levee. The conclusions drawn from the study on the Yellow River lower levee during the rain and flood have practical significances for the hydraulic engineering.

Key words [soil mechanics](#); [unsaturated soil slope](#); [permeability](#); [strength](#); [limit equilibrium](#)

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