

考虑饱和黏土埋深影响的一维非线性固结

马崇武¹, 刘忠玉²

(1. 东莞理工学院 建筑工程系, 广东 东莞 523808; 2. 郑州大学 土木工程学院, 河南 郑州 450001)

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摘要 由于饱和黏土层的埋深对初始有效应力影响较大, 因此也会对其非线性固结特性产生影响。假定孔隙比与有效应力对数和渗透系数对数之间分别存在线性关系, 那么可将考虑初始有效应力沿深度变化的饱和黏土一维非线性固结方程推广至考虑土层埋深的情况, 因此, 采用有限体积法对该方程进行数值求解。与 E. H. Davis 和 G. P. Raymond 非线性固结理论解析解的对比, 证明该方法的有效性。在此基础上, 探讨土层埋深、压缩指数与渗透指数的比值、地面均布荷载强度等参数对固结过程的影响。数值分析结果表明, 当上述 3 个参数分别增大时, 黏土层的沉降速率都将减小, 而埋深对孔压消散速率的影响规律则受压缩指数与渗透指数比值的制约。

关键词 [土力学; 非线性固结; 饱和黏土; 有限体积法; 沉降; 固结度; 埋深](#)

分类号

ONE-DIMENSIONAL NONLINEAR CONSOLIDATION CONSIDERING BURIED DEPTH OF SATURATED CLAY LAYER

MA Chongwu¹, LIU Zhongyu²

(1. Department of Civil Engineering, Dongguan University of Technology, Dongguan, Guangdong 523808, China;
2. School of Civil Engineering, Zhengzhou University, Zhengzhou, Henan 450001, China)

Abstract

The buried depth of saturated clay layer has great influence on the initial effective stress distribution, and consequently on the characteristics of its nonlinear consolidation. Based on the well-known assumption of the linear relation between the pore ratio and the logarithm of effective stress or permeability conductivity, the one-dimensional nonlinear consolidation equation considering the effects of the initial effective stress distribution is generalized to consider the buried depth of saturated clay layer, and numerical analysis is performed by using finite volume method. In order to verify its validity, the numerical solution by the present method for the case that the initial effective stress is constant with the depth and the ratio of the compressibility index to the permeability index that is equal to 1 is compared with the analytical solution based on the nonlinear consolidation theory proposed by E. H. Davis and G. P. Raymond. Then the effects of some parameters such as the buried depth of clay layer, the ratio of the compressibility index to the permeability index and the value of the vertical uniform load on the consolidation process are investigated. The numerical results indicate that the rate of settlement of clay layer decreases as these three parameters increase respectively, while the effect of the buried depth of clay layer on

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the dissipative process of pore water pressure is restricted by the ratio of compressibility index to permeability index.

Key words [soil mechanics](#); [nonlinear consolidation](#); [saturated clay](#); [finite volume method](#); [settlement](#); [degree of consolidation](#); [buried depth](#)

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