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软土地基孔隙水压力降低引起的压缩分析

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摘要　根据土力学基本原理，分析孔隙水压力降低引起的土体压缩方式，并对真空预压地基的分层沉降现场实测值和理论计算值进行分析；同时，定量分析真空预压地基在不同深处单位压缩量。研究结果表明：(1) 若按有效应力原理水土压力分开计算、地基土体中孔隙水压力降低时，土体竖向总应力维持不变而侧向总应力减小；(2) 土体中孔隙水压力在相对压强小于0的范围内降低时，将引起土体等向压缩，在相对压强大于0的范围内降低时，将引起土体单向压缩；(3) 南沙港区的真空预压地基若其沉降按欠固结计算时，计算值与实测值接近，自重应力欠固结引起的沉降是抽真空期间地基总沉降主要部分；(4) 真空预压的加固深度随排水体深度增加而增大，土层压密效果随地层深度增加而减弱，故降低孔隙水压力法在加固软土地基中，设计排水体深度时应考虑最佳加固深度。

关键词　土力学；软土地基；孔隙水压力降低；真空预压；压缩；加固深度

分类号

ANALYSIS OF SOIL COMPRESSION INDUCED BY PORE WATER PRESSURE DROP IN SOFT SOIL FOUNDATION

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Abstract

The compression modes of soil under pore water pressure drop are analyzed based on the basic principles of soil mechanics，and the layered settlements are investigated contrastively between theoretical calculation and field measurement in soft foundation improved with vacuum preloading. The unit compressions are analyzed quantitatively at different depths of soil and the following conclusions are drawn：(1) according to the analysis of the principle of effective stress，the soil pressure and the water pressure are calculated individually to arbitrary soil element，where the vertical total stress keeps constant and lateral total stress is reduced with the pore water pressure drop；(2) pore water pressure drop induces soil element isotropic compression in the range lower than local atmospheric pressure，and pore water pressure drop induces one-dimensional compression of soil element in the range greater than local atmospheric pressure；(3) the case study shows that calculated ground settlement by incomplete consolidation soil is consistent with the field measured settlement approximately in vacuum preloading project of Nansha Port，and the settlement induced by secondary consolidation of gravity is an important proportion of total ground settlement during the period of vacuum preloading；(4) the prefabricated

vertical drains are installed deeper，and the improvement depth of vacuum preloading is greater，however，the effect of soil compression is smaller with depth increase in vacuum preloading project. The design of prefabricated vertical drains should consider the optimal improved depth when soft foundation is improved with the technique of pore water pressure drop.
Key words soil mechanics；soft soil foundation；pore water pressure drop；vacuum preloading；compression；improvement depth

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