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桩-土复合地基抗液化数值试验分析

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THE NUMERICAL EXPERIMENTS AND ANALYSIS ON ANTI-LIQUEFACTION EFFECT OF PILE-SOIL COMPOSITE FOUNDATION

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摘要

在自由场中设置群桩基础，改变桩基间距，应用FLAC3D作系列三维桩基础非自由场液化数值模拟试验，从桩对液化土的反作用这一方面，研究群桩设置对场地液化分布的影响，揭示群桩抗液化效应。试验结果显示，群桩改变了自由场的特性，群桩非自由液化场水平向不再同性。相对于自由液化场，群桩约束了内部土体自由应变，加大了桩-土结构复合地基的整体抗剪刚度，适当间距的群桩抑制下部土液化的效应较明显，超孔压比降低20%，群桩对上部土体的抗液化效应不大。桩基间距越小对近处场地液化的抑制作用越大，对远处液化的强化作用也越大，桩间距越大抑制作用越小，对远处的强化作用也越小。桩间距相同，桩径加大，桩间场液化度降低。研究成果为桩-土结构复合地基抗液化设计提供理论及试验基础。

关键词： 群桩 桩间距 液化场 液化度 液化效应

Abstract:

By setting a group pile in a free field, changing the distance between piles, the series numerical simulation test was completed for the liquefaction in a pile-foundation non-free field by using FLAC3D. Studied the influence on liquefaction distribution features of the pile-foundation non-free field, and revealed the anti-liquefaction nature of a group-pile foundation. Experiment showed that: the non-free field liquefaction distribution approaches non-uniform in the horizontal direction, the pore-water pressure distribution shifted, the contour of pore pressure presents the fluctuation shape, nearby the structure forms the low pressure region, and forms the high pressure region several meters far to the structure. Contrast with the free liquefaction field, the excess pore pressure ratio in a low pressure region reduces obviously, approximately 20%, and the anti-liquefaction effect on top soil of a pile foundation was very limited. The excess pore pressure ratio in a high pressure region is higher than the free field. The group pile suppressed the vicinity soil liquefaction, and the piles strengthened the liquefaction in distant place soil. The bigger the pile rigidity is, the bigger the inhibition range is, and the bigger invigoration effect to the distant place liquefaction is also. The smaller the pile rigidity is, the smaller inhibition range is, and the smaller the invigoration effect to the distant place liquefaction is also. At same distance between piles, when the pile diameter is bigger, the excess pore pressure ratio in the field between piles is lower. Researching results will provide a theoretical and experimental basis for the anti-liquefaction design of underground pipes through the liquefied soil layer.

Key words: pile group distance between piles liquefaction field excess pore pressure ratio liquefaction effects

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