

Effectiveness of Lowering the Water Table as a Mitigation Measure for Foundation Settlement in Liquefiable Soils Using 1-g Scale Shake Table Test

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Abstract : An earthquake is an unpredictable natural disaster. It induces liquefaction, which causes considerable damage to the structure, life support, and piping systems because of ground settlement. As a result, people are incredibly concerned about how to resolve the situation. Previous researchers adopted different ground improvement techniques to reduce the settlement of the structure during earthquakes. This study evaluates the effectiveness of lowering the water table as a technique to mitigate foundation settlement in liquefiable soil. The performance will be evaluated based on foundation settlement and the reduction of excessive pore water pressure. In this study, a scaled model was prepared based on a full-scale shake table experiment conducted at the University of California, San Diego (UCSD). The model ground consists of three soil layers having a relative density of 55%, 45%, and 90%, respectively. A shallow foundation is seated over an unsaturated crust layer. After preparation of the model ground, the water table was measured to be at 45, 40, and 35 cm (from the bottom). Then, the input motions were applied for 10 seconds, with a peak acceleration of 0.25g and a constant frequency of 2.73 Hz. Based on the experimental results, the effectiveness of the lowering water table in reducing the foundation settlement and excess pore water pressure was evident. The foundation settlement was reduced from 50 mm to 5 mm. In addition, lowering the water table as a mitigation measure is a cost-effective way to decrease liquefaction-induced building settlement.

Keywords : foundation settlement, ground water table, liquefaction, shake table test

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