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Experimental Investigations on Pervious Concrete Piles in Saturated Ground Under Repeated Shaking Conditions

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Abstract

Abstract: Soil liquefaction has a significant influence in inducing structural failures during seismic events. Further, the recent repeated seismic events such as Christchurch earthquake (2010-2011), Tohoku earthquake (2011) raised alarm over the possibility of reliquefiaction occurrence in saturated grounds. To alleviate liquefaction effects, various ground improvements methods were being used continuously for improving the seismic resistance of saturated ground. Among those ground improvement techniques, use of stone column and sand compaction piles are the most commonly used ground reinforcement techniques. The improvement in load-carrying capacity and drainage characteristics highly benefit the seismic improvement in saturated ground. However, the performance of these conventional ground treatment systems also depends upon the confinement provided by the surrounding soils and its assessment under repeated shaking events also not available/limited. Considering this, use of pervious concrete pile (PCP) as an alternative to conventional stone column technique is attempted in this study. Considering the sustainability approach, the pervious concrete pile was prepared with construction and demolition waste. Further, the efficiency of pervious concrete pile in mitigating the liquefaction and reliquefiaction potential is also attempted in this study. For experimental studies, saturated ground having 40% relative density was prepared with and without pervious concrete pile treatment technique. Both, the unreinforced and pervious concrete pile reinforced ground was then subjected to repeated incremental acceleration of 0.1g, 0.2g, 0.3g and 0.4g with 5 Hz frequency to evaluate the seismic resistance of the prepared ground with and without improvement system. The variation in generation of excess pore water pressures ratio and settlement of untreated and pervious concrete pile treated ground was compared and observations on the obtained results were presented.

Keywords: Pervious concrete pile, Reliquefaction, Excess pore water pressure ratio