Abstract of the thesis

LOAD TRANSFER MECHANISM OF CONNECTED AND DISCONNECTED PILED RAFTS IN SAND – MODEL TESTING AND ANALYSIS

by

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ABSTRACT

The popularity of connected pied raft (CPR) system as foundation of high-rise building is huge because of its facility of simultaneous load sharing between piles and raft and effectiveness in reducing the settlement to an acceptable limit. However, the interactions between piles and raft makes the load sharing mechanism in CPR very complex and the accumulation of high axial stress and localized bending moment at the pile-raft connection might cause a sudden failure of the piles in high seismic and wind load dominant regions. To circumvent this problem, the innovative concept of disconnected piled raft (DPR) system, where the piles are structurally disconnected from the raft by a granular cushion layer, has immersed as a suitable and economic alternative to the CPRs. In this study, an attempt is made to investigate the fundamental aspect of load transfer mechanism of DPR and understand how it is different from that of a CPR system under vertical load. To fulfil this prime objective, scaled 1*g* physical model tests on CPR and DPR foundations are performed by varying pile spacing, pile length, raft thickness, cushion thickness and cushion granularity and the results are presented in a comprehensive and interesting manner. The settlement-dependent characteristics of pile-pile, pile-raft and raft-pile interaction factors in a CPR system under vertical load are evaluated experimentally and a simple mathematical model is proposed on the basis of these interaction factors and stiffness values of unpiled raft and pile group to estimate the loads shared by the piles and raft. The influences of cushion layer in terms of its thickness and granularity on the performance of DPR i.e., settlement efficiency, structural behavior of piles and pile-raft load sharing are examined thoroughly and optimum values of cushion thickness and granularity are obtained from these test results. The effects of various geometric design parameters on the overall performance of CPR and DPR are studied as well. Lastly, 3-D

finite element-based simulations are carried out to find out some intricate aspects of load transfer mechanisms of CPR and DPR which have not been addressed in the experimental study due to some limitations. Useful results are also presented to predict the behavior of prototype DPR system under vertical load. On the basis of the experimental results and findings from the numerical analyses, finally, some recommendations are provided regarding the design of DPR system which might be a viable and cost-effective alternative to the conventional CPR system for the low to medium rise buildings under vertical load.

Key words: Connected piled raft; Disconnected piled raft; Load transfer mechanism; Settlement efficiency; Pile-raft load share; Interaction factors; Model testing