University of Victoria | Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Applied Science

of

YUNJIE LIN

BSc (Zhejiang Sci-Tech University, 2017)

"Scour Effects on Lateral Behavior of Pile Foundations"

Department of Civil Engineering

Monday, August 19, 2019
9:30 A.M.
Engineering / Computer Science Building
Room 468

Supervisory Committee:
Dr. Cheng Lin, Department of Civil Engineering, University of Victoria (Supervisor)
Dr. Min Sun, Department of Civil Engineering, UVic (Member)

External Examiner:
Dr. Sanat Pokharel, Principal Engineer, Stratum Logics

Chair of Oral Examination:
Dr. Francis Zwiers, Department of Mathematics and Statistics, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

Scour is a phenomenon of soil erosion around foundations under currents and waves. It is a major cause for the disruption to water-borne structures such as bridges and marine structures. Pile foundations supporting these structures are required to be designed against the scour damage. However, at present, there is no accepted method for the design of piles in scoured conditions probably due to growing recognition of scour effects on foundations: (1) formation of scour hole around the foundation and (2) the scour induced changes in stress history of the remaining soils.

Although numerous efforts have been made to evaluate these scour effects on single piles using numerical simulations and centrifuges tests, the scour susceptibility in different soil properties is still unknown. Furthermore, there is no study concerning scour effects on the lateral responses of pile groups. Therefore, a series of three-dimensional finite element (FE) parametric analyses were conducted to investigate scour effects on lateral behavior of both single piles and free-head pile groups by varying scour-hole dimensions, soil properties, pile properties, and pile group configurations. Moreover, to facilitate the routine design, a modified *p-y* method that was modified based on the widely used *p-y* method was proposed for both scoured single piles and pile groups, and was validated against the results from the FE analyses. The results show that scour induced lateral capacity loss in both single piles and pile groups, which was approximately 10% more in dense sands than that in loose sands. Simplification of local scour as a general scour that has been commonly used in general design practice resulted in a maximum of 17% underestimation of lateral capacity of pile foundations. Pile groups were more susceptible to scour than single piles under equivalent scour conditions. A pile group with smaller pile spacing or larger pile numbers showed a less loss of lateral capacity due to scour.