

# Preface

Deep excavations in soft clay with an underlying aquifer lead to major concerns of ground deformation, soil–structure interaction and base instability due to hydraulic uplift. Given vast amount of case histories reported in the literature, it is still difficult to differentiate and understand ground deformations induced by excavations in densely built urban areas and greenfield sites. Moreover, reliable measurements of earth pressure on walls in excavations in soft clay are rarely reported. In spite of frequently reported base instabilities due to hydraulic uplift, the initiation and failure mechanism of base instability are not systematically investigated and well understood. Existing calculation methods against base instability may be too conservative and reserved to be improved.

As far as the authors are aware, this is the first book to present and interpret state-of-the-art experimental and theoretical work on ground deformation and base instability of deep excavations in soft clay subjected to hydraulic uplift. The technical contents of the book are condensed from the authors' most recent comprehensive research work carried out on the subject, based on dimensional analyses, well-instrumented full-scale field tests, systematic coupled-consolidation finite element analyses and state-of-the-art centrifuge tests.

To study ground deformation and soil–structure interaction, a diaphragm wall panel constructed at a greenfield site in Shanghai soft clay was comprehensively instrumented and monitored. Coupled-consolidation finite element analysis was conducted to back-analyse the case history. Moreover, a parametric study was carried out to investigate, understand and quantify key factors governing relatively small excavation-induced ground deformation in Shanghai. To study base instability due to hydraulic uplift, a new experimental setup was developed to simulate in-flight multi-propped excavation destabilised by hydraulic uplift in centrifuge. Centrifuge model tests and three-dimensional coupled-consolidation finite element analyses were carried out to investigate the initiation and failure mechanism of base instability due to hydraulic uplift in soft clay and effectiveness of using 'anti-uplift piles' for base stabilisation. Together with dimensional analysis and numerical

parametric studies, key variables affecting the initiation and failure mechanism of base instability are indentified.

This book consists of ten chapters. Chapters 1, 9 and 10 were jointly authored by Prof. L.Z. Wang and Dr. Y. Hong. The remaining chapters were mainly completed by Dr. Y. Hong, by taking comments and suggestions from Prof. Charles Ng (Dr. Y. Hong's Ph.D. supervisor) and Prof. L.Z. Wang into account. The authors gratefully acknowledge the financial support from the Research Grants Council of the HKSAR (General Research Fund No. 617511), International S&T Cooperation Program of China (No. 2015DFE72830), National Natural Science Foundation of China (No. 51408540), National Science Foundation for Distinguished Young Scholars of China (No. 51325901), State Key Program of National Natural Science of China (No. 51338009) and China Postdoctoral Science Foundation (No. 2013M540494).

The authors would like to express deep appreciation to many colleagues who contributed to the research work presented in this book.

Finally, the authors are very grateful to their family members, for their love, encouragement and support.

Hangzhou, China  
March 2015

Yi Hong  
Lizhong Wang

Deformation and Failure Mechanism of Excavation in  
Clay Subjected to Hydraulic Uplift

Hong, Y.; Wang, L.

2016, XIV, 156 p. 82 illus., 42 illus. in color., Hardcover

ISBN: 978-3-662-46506-6