

Foreword

The Design of Pile Foundations in Liquefiable Soils provides a systematic evaluation of the effects of liquefaction on pile foundations and includes earthquake observations, research findings, and design principles and procedures from a variety of sources worldwide. The book provides a logical framework for understanding the basics of single pile and pile group design, liquefaction, and the effects of earthquake loading and liquefaction on the axial and lateral loads transmitted to pile foundations. It also provides a framework for understanding the effects that loss of bearing and lateral restraint in saturated sandy soils subject to cyclic loading have on the capacity of pile foundations. By combining earthquake loading in liquefiable soils with mechanisms that reduce pile capacity, the book develops a rational process for quantifying loads and capacity reduction into a design process.

Pile response to earthquakes and liquefaction involves complex material behavior in terms of increased pore pressure and reduced soil strength and stiffness, complex mass behavior of the ground in terms of kinematic loading, complex performance of the superstructure in terms of inertial loads transmitted to the piles, and complex interaction between the soil and pile foundation. This book provides a valuable guide for students, researchers, and designers in navigating these complexities.

Chapter 1 focuses on the performance of pile foundations with a review of factors contributing to axial pile capacity, performance-based design principles for piles subject to earthquakes, and the observed performance of pile foundations during previous earthquakes. Chapter 2 reviews inertial and kinematic loading, and presents the essentials of p - y analysis and limit equilibrium methods to estimate the maximum shear

and moment in piles in laterally spreading soils. Chapter 3 covers factors affecting the axial loading of piles in liquefiable soils, including reduction in end-bearing capacity due to elevated pore pressures and the potential for beam buckling associated with the loss of lateral restraint in liquefying soils. Chapter 4 focuses on lateral spreading in liquefied soils, including empirical methods for estimating lateral spread movement, soil-pile interaction in liquefied soil, and limiting lateral earth pressures for pile design. Chapter 5 evaluates combined axial and lateral pile loading effects in laterally spreading ground with a treatment of single pile and pile group behaviour and the use of interaction diagrams to analyse pile performance when multiple failure mechanisms are possible. Chapter 6 provides a substantial number of design examples to illustrate the design procedures developed in the book.

The Design of Pile Foundations in Liquefiable Soils also demonstrates the importance of centrifuge testing to identify and quantify key failure mechanisms associated with complex soil-structure interaction. The combined use of careful field observations, centrifuge experiments and fundamental mechanics to develop analytical procedures and a structured design process is well illustrated by this book. The provision of design examples is a particularly attractive feature. The worked examples show explicitly how to apply the design process, and provide an indispensable link between theory and practice.

The Design of Pile Foundations in Liquefiable Soils provides substantial forward progress in conceptualising and formalising the analytical and design treatment of the truly complex, and sometimes vexing, phenomena associated with pile response to earthquake loading and liquefaction. For those interested in liquefaction, liquefaction-induced soil-structure interaction, pile design, and centrifuge testing, this book will be a valuable and frequently used addition to their technical library.

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