FIFTH EDITION

FUNDAMENTALS OF GEOTECHNICAL ENGINEERING

BRAJA M. DAS | NAGARATNAM SIVAKUGAN

Fundamentals of Geotechnical Engineering

Fifth Edition

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Braja M. Das
Dean Emeritus, California State University
Sacramento, California, USA

Nagaratnam Sivakugan
Associate Professor, College of Science, Technology & Engineering
James Cook University, Queensland, Australia

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Fundamentals of Geotechnical Engineering, Fifth Edition
Braja M. Das and Nagaratnam Sivakugan

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WCN: 01-100-101

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Library of Congress Control Number: 2015937334

ISBN-13: 978-1-305-63518-0

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Printed in the United States of America
Print Number: 01 Print Year: 2015

To Janice, Rohini, Joe,
Valerie and Elizabeth

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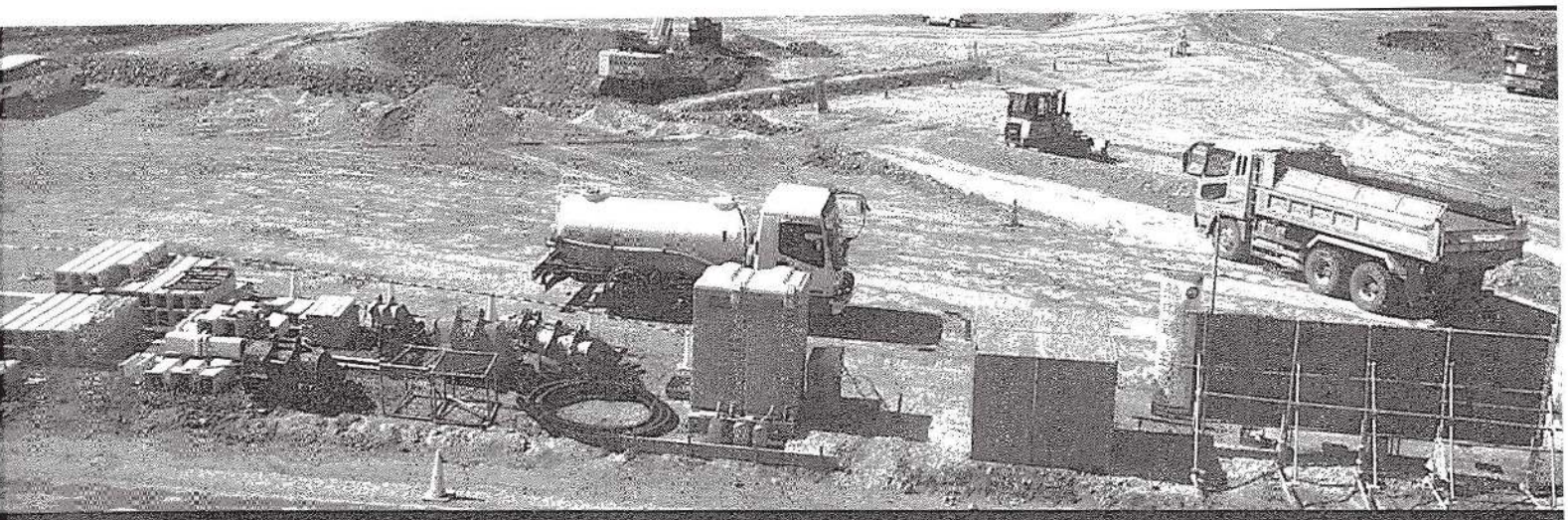

Preface

Principles of Foundation Engineering and *Principles of Geotechnical Engineering* were originally published with 1984 and 1985 copyrights, respectively. These texts were well received by instructors, students, and practitioners alike. Depending on the needs of the users, the texts were revised and are presently in their eighth editions. These texts have also been translated in several languages.

Toward the latter part of 1998, there were several requests to prepare a single volume that was concise in nature but combined the essential components of *Principles of Foundation Engineering* and *Principles of Geotechnical Engineering*. In response to those requests, the first edition of *Fundamentals of Geotechnical Engineering* was published in 2000. This text includes the fundamental concepts of soil mechanics as well as foundation engineering, including bearing capacity and settlement of shallow foundations (spread footings and mats), retaining walls, braced cuts, piles, and drilled shafts.

New to This Edition

This fifth edition has been revised and prepared based on comments received from several reviewers and users without changing the philosophy on which the text was originally prepared. Professor Nagaratnam Sivakugan of James Cook University, Australia, has joined as a co-author of this edition. As in the previous editions, SI units are used throughout the text. This edition consists of 20 chapters and an appendix. The major changes from the fourth edition include the following:

- About forty additional photographs have been added.
- A number of additional example problems and homework problems have been added in each chapter.
- Each chapter has some critical thinking problem(s) added to the homework problem set.

- An interactive digital version of this text is now available. Please see the MindTap description on page xix.
- In Chapter 2 on "Soil Deposits—Origin, Grain-Size, and Shape" a discussion has been added for the U.S. sieve size designations. Details for the British standard sieves and the Australian standard sieves have also been added.
- In Chapter 3 on "Weight-Volume Relationships and Plasticity," a table for various unit-weight relationships has been added.
- Chapter 4 on "Soil Classification" has a new section on visual identification of soils.
- In Chapter 5 on "Soil Compaction," some recently published correlations for maximum dry unit weight and optimum moisture content has been added. Also added in this chapter is a brief description on various ground improvement methods.
- Chapter 9 on "Consolidation" now has a new section on the effects of initial excess pore water pressure distribution on U–T_v relationships. Also added to this chapter is a discussion on the construction time correction of consolidation settlement.
- A number of recently published correlations for effective stress friction angle (ϕ') and cohesion (c') for cohesive soils has been added to Chapter 10 on "Shear Strength of Soils." Also included in this chapter are several correlations for the undrained shear strength of remolded clays with liquidity index.
- Chapter 12 on "Subsurface Exploration" now has a section on field instrumentation.
- In Chapter 13 on "Slope Stability," an analysis to evaluate the factor of safety of clay slopes with the undrained cohesion increasing with depth has been added. This chapter now also has a discussion on the mass procedure for stability analysis of homogeneous clay slopes ($\phi = 0$) with earthquake forces.
- Chapter 15 has been renamed as "Retaining Walls, Braced Cuts, and Sheet Pile Walls." Analyses of cantilever sheet pile walls and anchored sheet pile walls have been added to this chapter.
- The bearing capacity of strip foundation under eccentrically inclined load has been discussed in greater detail in Chapter 16 on "Shallow Foundations—Bearing Capacity."
- An improved method for elastic settlement calculation of shallow foundations on granular soil taking into consideration the variation of soil stiffness with stress level has been added to Chapter 17 on "Settlement of Shallow Foundations."
- A new chapter (Chapter 20) on "Load and Resistance Factor Design (LRFD)" has been added to the text.

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Acknowledgments

Thanks are due to:

The following reviewers for their comments and constructive suggestions:

- Alierza Bayat, University of Alberta
- Raymond Haddad, California State University, Northridge
- Anne Lemnitzer, University of California, Irvine
- Matthew Sleep, Oregon Institute of Technology
- Kamal Tawfiq, Florida A&M University
- Alexandria Wayllace, Colorado School of Mines
- Attila Michael Zsaki, Concordia University, Canada

Several individuals in Cengage Learning, for their assistance and advice in the final development of the text—namely:

- Tim Anderson, Product Director
- Mona Zeftel, Senior Content Developer

Thanks are also due to Janice Das for her continuous help in the development of the original text and its subsequent four editions.

It is also fitting to thank Rose P. Kernan of RPK Editorial Services. She has been instrumental in shaping the style and overseeing the production of this edition of *Fundamentals of Geotechnical Engineering* as well as all previous editions.

Braja M. Das
Henderson, Nevada, USA

Nagaratnam Sivakugan
Townsville, Queensland, Australia