Preface to the Second Edition

Since the publication of the first edition, the requirements for the design of concrete structures have gone through a number of changes as reflected in the American Concrete Institute, ACI 318 publication. The latest revision of the Code was published in 2014 and represents the state-of-the-art of the current knowledge in concrete and reinforced concrete design. This revision, ACI 318-14, forms the basis of the second edition of this textbook.

The book retains the features that made it well received by students, instructors, and practitioners alike. The popular step-by-step approach of problem solving, augmented by flowcharts and supported by numerical solutions, clearly describes the processes that need to be followed to provide safe and economical designs of reinforced concrete components. The self-experiments included at the end of the chapters help students better understand the behavior of concrete structures through the construction and testing of scaled models.

To make the book more useful to students in Construction Engineering programs, a new chapter (Chapter 8) on formworks for monolithic concrete construction has been added. This chapter covers the fundamentals of formwork and shoring design, and detailed step-by-step solutions of numerical problems along with mathematical formulae and tables to help students and practitioners to design these temporary structures. In addition, to provide more visual clarifications of the topics discussed in the book, a new appendix (Appendix B) is added, which includes color images of various stages of concrete construction and completed buildings.

We gratefully acknowledge the support of the following individuals and organizations by providing images that are used in the book: Professor Jack Davis, Dean of Virginia Tech College of Architecture and Urban Studies, Ms. Kathe Hooper from the American Society for Testing and Materials, Mr. Charles James from the National Information Service for Earthquake Engineering, Ms. Angela Matthews from the American Concrete Institute, Ms. Gwen Wang from the Portland Cement Association, and Mr. Doug Peters, PE, President of Christman Constructors, Inc.

We also owe special thanks to the following individuals: Mr. Nadir Makhlouf, a partner of Robert Darvas Associates, PC, for his great help in preparing the graphics work for Chapter 8, Mr. Xiaoyao Wang, Mr. Hasheem Halim, and Mr. Sriram Sankaranarayanan, students at Virginia Tech schools of architecture and engineering, for their efforts on updating the book and the solutions manual.

The authors would like to express their thanks to Springer International Publishing AG Switzerland, in particular Mr. Michael Luby, senior publishing editor, and Mr. Brian Halm, project coordinator for helping us bring this second edition to publication.

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The intended audience of this book is architectural engineering, undergraduate civil engineering, building construction, and architecture students. The manuscript complies with the provisions of the ACI Code 318-05. The easy to follow style of the text makes it valuable to engineering and nonengineering students. Furthermore, educators and practitioners interested in the analysis and design of concrete structures based on the latest ACI Code provisions may also benefit from it.

Chapter 1 covers the topic of concrete technology. It discusses the most important properties of the main components of reinforced concrete. This technology is essential for both architecture and engineering students.

Chapter 2 discusses the analysis and design of rectangular beams and one-way slabs, including a complete treatment of the Unified Design Method as recommended by the ACI 318-05. Several examples demonstrate the provisions of the latest changes in the ACI Code. It is written to benefit architecture and engineering students as well. Depending on the main objectives of the course and class time constraints, the instructor can select the specific topics and their details to be included for the intended audience.

Chapter 3 "Special Topics in Flexure" covers T-beams, doubly reinforced beams, and a discussion of the deflection of reinforced concrete beams and slabs. These topics are more complex, but indispensable in the design of concrete structures. The detailed technical information presented is essential for engineering students. We recommend that only a brief discussion of each topic be used in courses for architecture students.

Chapter 4 "Shear in Reinforced Concrete Beams" covers the design of shear reinforcements in reinforced concrete beams. We consider this chapter to be important in both engineering and architecture courses. The depth of coverage may be left to the discretion of the instructor.

Chapter 5 covers the analysis and design of reinforced concrete columns. It includes a complete treatment of "short" columns with small and large eccentricities. Because most reinforced concrete columns are short and a complete treatment of slender columns is usually only covered in advanced engineering

courses, we decided to cover that topic generally. We recommend this chapter be covered in engineering and architecture courses.

Chapter 6 is a treatise on the different floor systems typically used in reinforced concrete buildings. A simplified approach appropriate for both architecture and engineering students is used.

Chapter 7 discusses foundations and earth-retaining walls. The chapter starts with a background on some aspects of soil mechanics and geotechnical investigations for building design. These topics are not usually covered in reinforced concrete structures textbooks. However, we are aware that many engineering students do not take a soil mechanics course as a prerequisite for a reinforced concrete class. Furthermore, soil mechanics and foundations courses are unavailable in nearly all architecture curriculums. The treatment of the subjects of foundations and earth-retaining walls are well-suited for both architecture and engineering students.

Chapter 8 is an introduction to prestressed concrete for both architecture and engineering students.

Chapter 9 discusses the use of the SI System in reinforced concrete design and construction. We decided against the use of the equivalent SI System within the main body of the book, as is done in many other textbooks. We felt that this resulted in a clearer text. Several examples on different topics covered in other chapters are again presented using the equivalent SI System.

Two unique features of this book are the "self-experiments" and an accompanying CD with images of concrete structures. From our experience we know that some engineering students and nearly all architecture students do not have access to a testing laboratory. Therefore, we included these simple-to-do sets of experiments that students can perform to learn about reinforced concrete from their own experiences. We believe these experiments may also help students gain a better understanding of concrete as a building material. The accompanying CD has a number of high-quality images of reinforced concrete structures, so that students can develop an appreciation of the potential this building material offers.

There are numerous problems at the ends of each chapter to be used as homework assignments. A complete Instructor's Solutions Manual is available upon request.

A step-by-step approach was adopted throughout the text. Most of the procedures for design or analysis are summarized in flowcharts, where all steps are numbered, and the example solutions follow these steps. In our experience this approach helps students try to follow the numerical solutions of various problems.

We would like to thank Professors Jay Stoeckel, Jack Davis, and Mr. Gerry Martin from the Ceco Concrete Construction, LLC, for providing some of the images in the accompanying CD-ROM. The continued educational support by the Northeast Cement Shippers Association, and in particular Kim Frankin, is greatly appreciated. We are also grateful to students at the School of Architecture + Design of Virginia Tech for their help and comments during the development of this book, in particular Mr. Amir Abu-Jaber for his assistance in typing and editing the manuscript and the solutions manual.

Finally, we wish to thank the Pearson Education editorial and production staff for their support and assistance. Many thanks to Bret Workman, who did a great job with text editing. In particular, the assistance of Penny Walker from Techbooks is greatly appreciated.

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http://www.springer.com/978-3-319-24113-5

Concrete Structures

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2017, XVIII, 680 p. 428 illus., Hardcover
ISBN: 978-3-319-24113-5