

How to Use This Book

What You'll Need

This book is designed to complement and be used with PPI's *Civil Engineering Reference Manual* (CERM), *Structural Depth Reference Manual* (CEST), or *SE Structural Engineering Reference Manual* (STRM). CERM, CEST, and STRM are the basic texts for anyone studying for the NCEES civil Principles and Practice of Engineering (PE) or the structural engineering (SE) exams, and each book contains an introduction to the basic concepts and most common applications pertaining to concrete design.

It is essential that this book be used with the American Concrete Institute's *Building Code Requirements for Structural Concrete* (ACI 318-14) and *Commentary* (ACI 318R-14). The following chapters are meant to explain and clarify those aspects of the building code that are most likely to come up during the PE civil and SE exams, but it will be frequently assumed along the way that you can refer directly to the code itself when necessary.

Throughout the book, citations to code criteria refer to the 2014 edition of the ACI code. For example, the citation "ACI Sec. 7.12" refers to Sec. 7.12 of ACI 318-14.

When it comes to the exam itself, of course, it's important to bring the editions of the design standards that the current exam is based on. Check the NCEES website at ncees.org for the current design standards for your exam. You can also check PPI's website at ppi2pass.com/civil or ppi2pass.com/structural for current information and answers to frequently asked questions (FAQs) about the PE civil or SE exams.

Studying with This Book

Each chapter in this book treats a different topic. If you only want to brush up on a few specific subjects, you may want to study only those particular chapters. However, later chapters frequently build on concepts and information that have been set out in earlier chapters, and the book is most easily studied by reading the chapters in order.

The PE civil and SE exams are open book, so it is a very good idea as you study to mark pages in both ACI 318 and this book that contain important information, such as tables, graphs, and commonly used equations, for quick reference during the exam. (Some states don't allow removable tabs in books brought into the exam. Check with your state board, or use permanent tabs.) Become as familiar as possible with this book and with ACI 318. Remember that preparation and organization are as important to passing the PE and SE exams as knowledge is.

Throughout the book, example problems illustrate how to use the standard design principles, methods, and formulas to tackle common situations you may encounter on the exam. Take your time with these and make sure you understand each example before moving ahead. Keep in mind, though, that in actual design situations there are often several correct solutions to the same problem.

Practice Problems for Each Exam

In the last chapter of the book you'll find 37 practice problems. Whether you're studying for the structural depth section of the PE civil exam, or the SE exam, you'll find practice problems that are similar in scope, subject matter, and difficulty to problems you'll encounter on the actual exam.

The NCEES PE exam in civil engineering consists of two 4-hour sections, separated by a one-hour lunch period. Both sections contain 40 multiple-choice problems, and you must answer all problems in each section to receive full credit. There are no optional questions. The breadth section is taken in the morning by all examinees, and may include general concrete problems. In the afternoon, you are able to select from five depth sections: water resources and environmental, geotechnical, transportation, construction, and structural. The structural depth section covers a range of structural engineering topics including loads and load applications; forces and load effects; materials and material properties; component design and detailing; codes, standards,

and guidance documents; and temporary structures and other topics. The first 25 practice problems in the last chapter of this book are appropriate for the topics covered on the structural depth section of the PE civil exam.

The structural engineering (SE) exam is a 16-hour exam offered in two parts. The first part, vertical forces (gravity/other) and incidental lateral, takes place on a Friday. The second part, lateral forces (wind/earthquake), takes place on a Saturday. Each part comprises a breadth section and a depth section. The breadth sections in the morning are each four hours and contain 40 multiple-choice problems that cover a range of structural engineering topics specific to vertical and lateral forces. The depth sections in the afternoon are also each four hours, but instead of multiple-choice problems, they contain essay (design) problems. You may choose either the bridges or the buildings depth section, but you must work the same depth section across both parts of the exam. That is, if you choose to work buildings for the lateral forces part, you must also work buildings for the vertical forces part.

According to NCEES, the vertical forces (gravity/other) and incidental lateral breadth section covers analysis of structures, including loads and methods; design and details of structures, including general structural considerations, structural systems integration, structural steel, cold-formed steel, concrete, wood, masonry, foundations, and retaining structures.

The lateral forces (wind/earthquake) breadth section covers analysis of structures, including lateral forces, lateral force distribution, and methods; design and detailing of structures, including general structural considerations, structural systems integration, structural steel, cold-formed steel, concrete, wood, masonry, foundations, and retaining structures.

The vertical forces (gravity/other) and incidental lateral depth section buildings module covers loads, lateral earth pressures, analysis methods, general structural considerations (e.g., element design), structural systems integration (e.g., connections), and foundations and retaining structures. The bridges module covers gravity loads, superstructures, substructures, and lateral loads other than wind and seismic. It may also require pedestrian bridge and/or vehicular bridge knowledge.

The lateral forces (wind/earthquake) depth section buildings module covers lateral forces, lateral force distribution, analysis methods, general structural considerations (e.g., element design), structural systems integration (e.g., connections), and foundations and retaining structures. The bridges module covers gravity loads, superstructures, substructures, and lateral forces. It may also require pedestrian bridge and/or vehicular bridge knowledge.

The first 35 practice problems in the last chapter of this book are patterned after questions on the breadth sections of the SE exam. These problems cover the full range of concrete design topics and show the range of effort needed to solve them. The last two problems in this book are scenario problems related to concrete building structures, and are intended to illustrate the type of problems likely to appear on the depth sections of the SE exam.

When you feel comfortable with the principles and methods taught by the example problems, work these practice problems under exam conditions. Try to solve them without referring to the solutions, and limit yourself to the tools and references you'll have with you during the actual exam—an NCEES-approved calculator, pencil and scratch paper, and the references you plan to bring. When you have finished with the practice problems that are tailored to the exam you're taking, try some of the others as well. Getting all the practice in problem-solving that you can is one of the best ways to improve how you do on exam day.

After studying this book, you should be able to solve most common problems in structural concrete, both on the exams and in real design applications. Good luck on the exam!