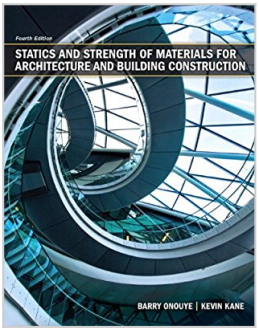

Statics and Strength of Materials for Architecture and Building Construction (4th Edition)

By Barry S. Onouye, Kevin Kane

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Statics and Strength of Materials for Architecture and Building Construction, Fourth Edition, *offers students an accessible, visually oriented introduction to structural theory that doesn't rely on calculus. Instead, illustrations and examples of building frameworks and components enable students to better visualize the connection between theoretical concepts and the experiential nature of real buildings and materials. This new edition includes fully worked examples in each chapter, a companion website with extra practice problems, and expanded treatment of load tracing.*

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Statics and Strength of Materials for Architecture and Building Construction (4th Edition) By Barry S. Onouye, Kevin Kane Bibliography

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Editorial Review

From the Back Cover
An ideal reference source for architects, builders, and engineers, this user-friendly guide provides an informative, richly illustrated and generously applied introduction to structures. Covers load paths (tracing) in an extensive, organized, and highly visual manner, and fully integrates building structures (structural design) with architectural and construction issues. Comes profusely illustrated, representing structural elements as a part of an assemblage rather than as a discrete part, and presenting a variety of two- and three-dimensional drawings to show the structural element and its context. Presents "architectural" (rather than "scientific") illustrations/diagrams with building construction examples, and places layout-figures and illustrations adjacent to the discussion. Biographies of prominent contributors to the areas of statics and strength of materials offer historical background.

A primary aim of this book has been to develop and present basic structural concepts in an easily understood manner using "building" examples and illustrations to supplement the text. Much of this material has been field tested, revised, and modified over a course of 25 years of teaching.

Introducing structural theory, without relying on a predominantly mathematical treatment, has been challenging to say the least—and a non-calculus engineering alternative to the topic seemed essential if the target audience (students of architecture, building construction, and some engineering technology programs) were to remain interested. Early on it was decided that a heavily illustrated, visual approach was essential in connecting and linking structural theory to real buildings and components. Using examples and problems that are commonly found in buildings and structures around us seemed to be a logical way of introducing mathematically based material in a nonthreatening way.

This text is organized along the lines of traditional textbooks on statics and strength of materials because it seems to be the most logical approach. A sound understanding of statics and strength of materials establishes a theoretical and scientific basis for understanding structural theory Numerical 5alculations are included as a way of explaining and testing one's understanding of the principles involved. Many fully worked example problems are included, with additional problems for student practice. An interesting, descriptive narrative of structural concepts may stimulate the student's interest in the subject matter, but it does not engage the student enough to ensure understanding.

This text is intended as the next step following a basic introductory course on structural principles (for example, Salvadori and Heller's *Structure in Architecture–The Building of Buildings*). Organizationally, the book consists of two parts: Statics in Chapters 2 through 4, and Strength of Materials covered in Chapters 5 through 10. Load Tracing in Chapter 4 is not customarily covered in statics, but was intentionally included to illustrate the power of the basic principle of mechanics and the use of free-body diagrams. Gravity and lateral load tracing are often covered in subsequent structures courses, but the fundamentals can be introduced at this stage without much anxiety on the student's part. Chapter 11 is included as a synthesis of the prior topics and summarizes some of the overall architectural, structural, and constructional issues outlined in the introduction to Chapter 1.

A heavy emphasis is placed on the use of free-body diagrams in understanding the forces acting on a

structural member. All problems begin with a pictorial representation of a structural component or assembly and are accompanied by a free-body diagram. Illustrations are used extensively to ensure that the student sees the connection between the real object and its abstraction. Chapter 3 uses the principles discussed in the previous chapter to solve an array of determinate structural frameworks. Load tracing in Chapter 4 attempts to examine the overall structural condition with regard to gravity and lateral loads. This chapter illustrates the interaction of one member with other members and introduces the concept of load paths that develop within a building.

Chapter 5 introduces the concepts of stress and strain and material properties as they relate to materials commonly used in the building industry. The text would be greatly complemented by a course on the methods and materials of construction taken concurrently or before the strength of materials portion. Cross-sectional properties are covered in Chapter 6, again with an emphasis on commonly used beam and column shapes. Chapters 7, 8, and 9 develop the basis for beam and column analysis and design. Chapter 10 on steel connections has been added to this second edition to emphasize the importance of the interconnection of parts in creating a stable, functional, and economical structure. Elastic theory has been utilized throughout, and the allowable stress method has been employed for the design of beams and columns. Some simplifications have been introduced to beam and column design equations to eliminate the complexity unwarranted for preliminary design purposes. Sizing of beams and columns is well within the range of a final, closely engineered element sized by the more complex formulas. It is assumed that students will take subsequent courses in timber, steel, and concrete. Therefore, building code equations and criteria have not been incorporated in these chapters.

No attempt was made to include the study of indeterminate beams and frames since it would require substantial development beyond the purview of statics and strength of materials. Indeterminate structures is probably one of the more important structural topics for building designers since most of the commercial and institutional buildings of moderate size are of this type. Indeterminate structural behavior using one of the many available structural analysis software packages is emerging as a critical area of study for all future building designers.

This text is intended to be used for a one-semester (15-week) class or two 10-week quarters in architectural, building construction, and engineering technology programs. Chapters 4 and 10 might be of interest and use to the civil engineering student who wants to better understand building components in a larger context. Also, Chapters 8 and 9 might be useful for quick preliminary methods of sizing beams and columns. Although this text might be used for self-study, its real benefit is to supplement the instruction received in class.

Many of the topics covered in the text can be demonstrated in model form in class. Slides of actual buildings representing the subject being covered help to reinforce the idea through visual images. Previous teaching experience has been convincing about the need to use a variety of media and techniques to illustrate a concept. Structures should by no means be a "dry" subject.

Computers and the availability of powerful structural software for desktop and laptop computers have revolutionized the field of structural analysis and design. Most students enrolled in our programs are generally quite computer literate and expect extensive use of structural software in solving statics and strength of materials problems. However, it is this author's belief that the basic principles and numerical techniques used in this book are easily within the grasp and understanding of our students. A sound, fundamental working knowledge of free-body diagrams, equations of equilibrium, stress, strain, and bending equations are key to developing a mental framework for the understanding of structural behavior. Basic equations of equilibrium, although quantitative in nature, still evokes a qualitative, intuitive sense about a structure. Matrix-based computer programs are highly abstract and mathematical with little connectivity to

real structures, except perhaps for the exceptionally gifted student.

Computers can certainly be used to supplement these early foundation structures courses and add to the student's understanding of structural behavior through the generation of graphically displayed output. Although there are many excellent structural analysis/design software packages available for purchase, reference will be made in selected sections of this book to *free* structural software of a limited nature accessible on the Internet.

As part of an ongoing effort by the United States to convert from the U.S. customary system of units to the international system of units (SI metric units), some example and practice problems in this text use the SI units. A table defining both the U.S. customary system of units and the SI metric units is included on page vii.

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I am indebted and grateful to a vast number of students over many years who have used the earlier versions of this text and generously given suggestions for changes and improvements.

In particular, this book would not be possible without the shared authorship of Kevin Kane and his skill and insightfulness illustrating the structural concepts. Kevin's major contributions, along with drawing and coordinating all of the illustrations, are evident in Chapters 4 and 10. Additional thanks to Cynthia Esselman, Murray Hutchins, and Gail Wong for drawing assistance that helped us meet deadlines.

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A warm and sincere thanks to our families for their support and sacrifice throughout this process. Thank you Yvonne, Jacob, Qingyu, Jake, Amia, and Aidan.

Barry Onouye

Users Review

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Kirsten Muncy:

This Statics and Strength of Materials for Architecture and Building Construction (4th Edition) book is absolutely not ordinary book, you have it then the world is in your hands. The benefit you get by reading this book will be information inside this publication incredible fresh, you will get facts which is getting deeper you actually read a lot of information you will get. This specific Statics and Strength of Materials for

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Benita Newton:

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