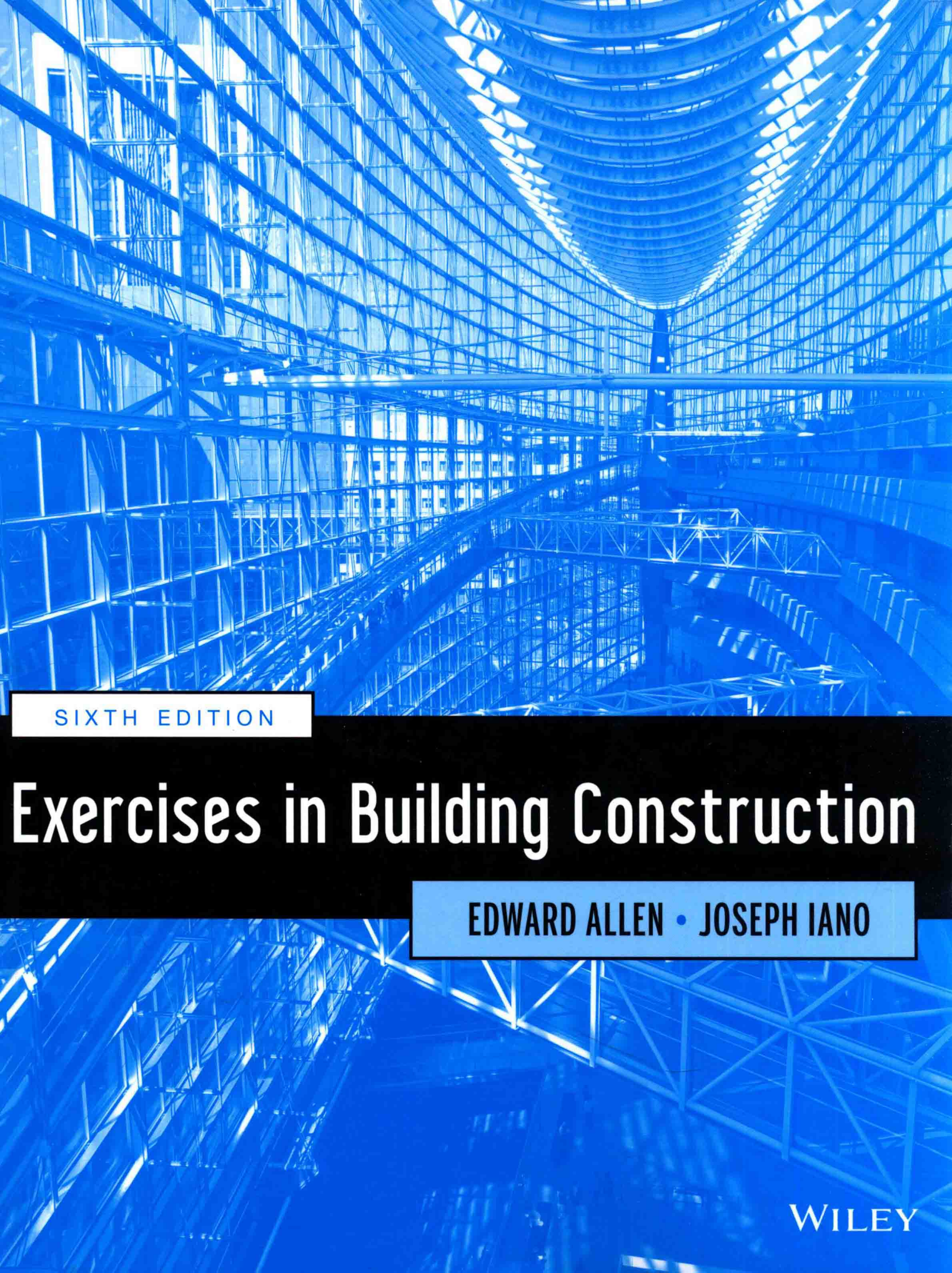

SIXTH EDITION

Exercises in Building Construction

EDWARD ALLEN • JOSEPH IANO

WILEY

EXERCISES IN BUILDING CONSTRUCTION

SIXTH EDITION

Forty-Six Homework and Laboratory Assignments to Accompany

FUNDAMENTALS OF BUILDING CONSTRUCTION
MATERIALS AND METHODS
SIXTH EDITION

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and
Joseph Iano

WILEY

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Getting Started with the Exercises

The exercises in this book are designed to help you learn about materials and methods of construction by involving you in the kinds of work that building design professionals--architects, engineers, and drafters--do every day in the course of designing buildings and getting them built. You will find that these exercises make it easier to learn the essential information in the accompanying textbook, Fundamentals of Building Construction. You will also discover that they will give you a good start toward becoming proficient in many different phases of building activity.

Keep Fundamentals of Building Construction close by as you do the work in this book, and get into the habit of consulting it frequently. Nearly everything you need to know to solve the problems is in this textbook, and in most cases you will be given explicit directions about where to look for it. The glossary at the end of the text will be useful if you do not understand a technical term, and the index can help you locate information that is not directly referenced in the exercises.

These exercises are intended to be hand drafted. Despite the dominance of digital technology in production drawing, the skills you will develop in these exercises--to conceptualize and develop building assemblies with confidence and ease--remain fundamental. You may draw freehand or with the aid of a drafting board and instruments, as you prefer or as directed by your instructor. In either case, only minimal use of an architect's scale is required. You can scale your drawing using the squares of the printed grid and the scale designation at the lower corner of the page. Always complete your solution to the given scale. Only on pages where no scale is given should you not work to scale.

(continued on next page)

You will often be asked to draw a section detail of a building assembly such as a wall, column, floor, or beam. You will find that the easiest way to do this is to **draw the components of your detail in the same sequence in which they will be assembled in the actual building**. First draw the basic structural components, then the major parts added to the structure, then the finish and trim pieces. This will help you learn the underlying logic of the detail and thereby remember the detail more easily. Trying to learn a complex detail by staring at it and attempting to memorize its shapes is virtually impossible for most people, and is not at all useful in increasing your understanding or professional skills.

Block out each drawing on the page with light lines before you begin to draw final lines. Outline lightly all major components of your solution. If you are in doubt about what to do next, use tracing paper or scratch paper to test alternatives before you commit lines to the sheet you will turn in. When you are satisfied that you have everything right, darken the lines to produce the finished drawing. If you work freehand (which is the mode we encourage you to try), draw each line cleanly with a single careful stroke--don't scribble back and forth. Finally, add notes and labels to explain what each component is.

You may find the exercises difficult at first, but if you follow the procedures we have recommended, they will become easier and more enjoyable as you acquire experience and gain confidence in your growing abilities.

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1

MAKING BUILDINGS

Assessing Sustainable Buildings 1.1

This exercise will introduce you to the LEED green building rating system for new construction, LEED-NC. To complete this exercise, you will need to refer to information outside of that included in your textbook. This information may be provided by your instructor, available in your school library, or obtained from a variety of online sources.

For questions regarding the LEED for New Construction checklist, see Figure 1.2 in the text. For more detailed information about the LEED-NC rating system, you may refer to the U.S. Green Building Council (USGBC) reference guide listed in Selected References at the end of Chapter 1, if this reference is available in your classroom or school library. Or you may go to the USGBC web site and follow links to LEED for New Construction, where more information about this rating system's requirements can be found.

Information about sustainably designed buildings can be obtained from many sources, including, for example, most architectural magazines, the USGBC web site, and many other web sites.

Alternatively, this assignment can be completed using the Living Building Challenge rating system. In this case, select any two imperatives from either the Health or Materials petals, in place of the LEED prerequisite, credit, and credit categories referred to in the assignment.

Refer to LEED for New Construction to answer the following questions.

1. From either of the main credit categories Materials and Resources or Indoor Environmental Quality, choose one prerequisite and one optional credit. List them here.

   Category:

   Prerequisite:

   Credit:

2. Briefly describe the intent of the category, prerequisite, and credit you have selected, using one or a few succinct sentences for each.

   Category:

   Prerequisite:

   Credit:

3. For the chosen prerequisite and credit, give an example of how to achieve each.

   Prerequisite:

   Credit:

Name: _____

4. Choose a LEED-rated building, either in design or fully constructed, for which you have access to information about its construction materials and methods. Answer the following questions.

a. What rating level (Platinum, Silver, etc.) is this building designed to?

b. Describe one prerequisite and one credit in either the Materials and Resources or Indoor Environmental Quality credit categories.

Name: _____

Building Code Restrictions 1.2

In this exercise you will become familiar with some of the important ways in which building codes affect the design of buildings. To complete this exercise, you will need to refer to Figures 1.3, 1.4, and 1.7 of the textbook, as well as to the list of Occupancy Groups provided in the accompanying text. You may also find it helpful to review the example application of these building code requirements to the design of a hypothetical commercial building included in the same section.

The building code includes many provisions for adjusting building height, area, and fire resistance requirements. For this exercise, apply only the following modifications to the information provided in your text unless directed otherwise by your instructor:

-For buildings two stories in height, the combined area of both floors may be double the allowable area for one floor listed in Table 503 of Figure 1.3.

-For buildings three or more stories in height, the combined area of all floors may be up to three times the area for one floor listed in the table.

If the building is fully sprinklered, you may also apply the following adjustments. These adjustments may be applied in combination with those previously listed:

-For a single-story building, the allowable building area may be quadrupled.

-For a building of two or more stories, the allowable height may be increased by 1 story and 20 feet, and the allowable area may be tripled.

Building Code Restrictions

1. An old, unsprinklered warehouse of Heavy Timber construction with exterior walls of brick masonry is being considered for conversion to a drama theater. The building is two stories high, 80' by 70' in plan, and conforms to the definition of Type IV (HT) Construction. Theaters are Occupancy A-1.
   a. Is this conversion within the height and area limits of the International Building Code (IBC)? _____
   b. If exterior bearing wall modifications are required, what fire resistance rating must be maintained? Ignore the influence of any adjacent buildings. _____

2. A client has asked you to design a clothing store of protected platform frame, Type VA, wood construction. The building will not be sprinklered.
   a. How tall can this building be? _____
   b. If built to its maximum permitted height, what is the maximum allowable area for all floors combined? _____
   c. What is the required fire resistance rating for components of the structural frame? _____

3. What is the maximum height for a reinforced concrete office tower of Type 1A construction? _____
   a. What is the required fire resistance rating for columns? _____
   b. What fire resistance is required for floor beams? _____
   c. Why do you think the answers in a. and b. differ?

      _____

      _____

      _____

   d. A large concert hall is to be housed in the same structure. Assuming the two occupancies abut side-by-side, what fire resistance rating is required for a fire wall separating the two occupancies so that each may be treated as a separate building from a code standpoint? _____

Name: _____

4. You have decided to use steel framing, Construction Type I or II, for a new five-story hotel, Occupancy Group R-1, with 41,500 square feet per floor. The building will be fully sprinklered.

   a. What is the least expensive (lowest fire-rated) Construction Type you are permitted to use? _____

   b. How tall, in feet and number of stories, may the building be? _____

   c. What level of fire protection will be required for each of the following elements of this building?
   Structural frame: _____
   Floor construction: _____
   Roof construction: _____

   d. There is an public way, with a 15-foot-wide fire separation distance, along one side of your building. The building owner would like to develop this way as a pedestrian shopping lane. Can an all-glass exterior wall, with a fire resistance rating of zero, be used along this edge of the building? (See Figure 1.4 in the text, IBC Table 602.) _____

5. How tall, in number of stories and in feet above grade, can you build an apartment building, Occupancy Group R-2, made of wood light frame construction with floor joists and roof rafters left exposed inside, Construction Type VB? The building will be fully sprinklered. _____

Observing Construction 1.3

Real buildings do not get built on paper! Seeing construction take place in the realm of soils, building materials, labor, construction equipment, and weather is an essential part of learning about the making of buildings. The ability to knowledgeably observe work in progress is also an important skill for the design or construction professional. In this exercise, you will visit a construction site to observe work in progress, record your observations, and, where necessary, follow up later with analysis of what you have seen.

Your instructor will provide specifics related to the duration and scope of this assignment. It may be performed in the course of a single site visit or span a series of regular visits to a site over the course of the term.

Observations should be made in the form of notes and annotated sketches or photographs. In cases where follow-up comments or research are needed, provide concise, clear explanations, and note your sources of information. You may use the form on the following pages as a template for recording your observations and follow-up notes. Make additional copies of these pages as needed.

During each visit, try to answer as many of the following questions as possible:

1. What **types of work** are underway during your visit--for example, concrete pouring, excavation of soil, steel erection, wood framing, etc.? What are the trades performing the work you observed (carpenters doing rough framing, bricklayers laying brick, drywall finishers taping gypsum wallboard, etc.)?
2. What are the **weather** conditions during your visit (temperature, precipitation, humidity, sky cover)? How is this affecting the work?
3. What **materials** are being stored, delivered, or removed from the site (excavated soil being trucked offsite, delivery of steel concrete reinforcing bars, stockpiling of lumber, etc.)?

4. What are the building's primary **structural materials** (steel frame with cast-in-place concrete floors, light wood frame with OSB sheathing, etc.)? Follow-up: Is this combustible or noncombustible construction? Referring to Figures 1.2 and 1.3 in the text, what Construction Types might this building be?

5. If possible, describe the **exterior wall system**, listing components in order from exterior cladding to interior finish. Follow-up: For elements that cannot be determined from your observations, suggest possible materials and explain why you think they might be an appropriate choice for this project.

6. What kinds of **temporary supports, services, protection, lifting machinery, and other materials and processes related to construction activity** can you see (excavation shoring, erosion control, dewatering, temporary bracing, scaffolding, formwork, tree protection, wind protection, temporary heating, power, worker fall protection, temporary guard rails, etc.)? Follow-up: Explain their purpose.

7. What aspects of the **site's physical organization** reflect the need to facilitate the movement of construction materials, labor, and machinery around the site?

8. If you have the opportunity to **talk with a site supervisor**, ask about the organization and challenges of the construction process. How long is the construction planned to take? What activities are most affecting the schedule? What aspects of the construction are most technically challenging or unusual?

9. What do you see that you do not understand? Describe, sketch, or photograph these items. Follow-up: Using the book as a reference or by comparing notes with your classmates, try to explain what you saw.