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Instructor's Manual

for

ESTIMATING IN BUILDING CONSTRUCTION

Ninth Edition

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Preface

The following key changes have been made to this edition:

- A chapter (Chapter 9) has been added covering specialty contractors.
- Chapter 15 (formerly Chapter 14) Thermal and Moisture Protection has been rewritten.
- Chapter 17 (formerly Chapter 16) Finishes has been rewritten.
- The text has been aligned to the student learning outcomes by major accreditation bodies.
- Pricing has been updated.
- The appendices have been reorganized.
- A larger image resource bank has been included in the instructor resources.

It is my hope that these changes will help you provide a more meaningful educational experience for your students.

Best wishes,

Steven Peterson

Outcomes

During the past few years, higher education has been moving to outcome based learning, which requires accredited programs to measure their students' ability to meet the required outcomes. Currently in the United States there are four accreditation standards for construction management and construction engineering programs, which are as follows: (1) American Council for Construction Education (ACCE); (2) ABET—Engineering Accreditation Commission, for construction engineering; (3) ABET—Engineering Technology, for construction engineering technology; and (4) ABET—Applied Science, for construction management. Although each of these standards are different, they all focus on three general outcomes, which can be summarized as follows. Construction management/engineering students should be able to:

- Prepare construction cost estimates. This book includes multiple sets of plans that may be used to prepare an estimate. Each chapter, where applicable, includes homework problems related to these plans. By completing the following problems, the students will complete an estimate for the Real Estate Office:
 - Chapter 6 Problems 12 and 13
 - Chapter 7 Problems 31 and 32
 - Chapter 9 Problem 7
 - Chapter 10 Problem 48
 - Chapter 11 Problem 64
 - Chapter 12 Problem 22
 - Chapter 14 Problems 45 and 46
 - Chapter 15 30 through 32
 - Chapter 16 Problems 19 and 20
 - Chapter 17 Problems 33 through 37
 - Chapter 18 Problem 9
 - Chapter 19 Problem 9
 - Chapter 20 Problem 6

- Effectively communicate in writing. Chapter 9 Problem 7 requires the student to write scopes of work for the Real Estate Office in Appendix E that clearly communicate the work to be performed by the specialty contractor. The following problems required the student to prepare written responses:
 - Chapter 1, Problems 11 and 12
 - Chapter 2 Problem 14
 - Chapter 3 Problem 13
 - Chapter 4 Problems 9 and 10
 - Chapter 5 Problems 8 and 9
 - Chapter 8 Problem 10
 - Chapter 9 Problem 7

- Understand ethics as it relates to estimating:
 - Chapter 4, Problem 13

Chapter 1—Introduction to Estimating

LEARNING OBJECTIVES

Gain an overall picture of estimating including the difference types of estimates, the careers available to estimators, what it takes to be a successful estimator, and what comprises the contract documents on which the estimate is based.

ACTIVITIES

1. Invite an estimator from industry to discuss his or her job with the students. Have him or her answer the following questions:
 - How does he or she go about estimating a project?
 - What are the different types of estimating method he or she uses?
 - What roll does estimating play in the success of his or her company?
 - What does it take to be a successful estimator?Encourage them to tell estimating related stories.
2. Discuss Problems 11 and 12 from the chapter.

INSTRUCTIONAL RESOURCES

PowerPoint Slides: Chapter 01.ppt

SOLUTIONS TO THE REVIEW QUESTIONS

1. What information is contained in the working drawings?

The working drawings are the actual plans (drawings, illustrations) from which the project will be constructed. Those drawings contain the dimensions and locations of building elements, the materials required, and delineate how they fit together.
2. What information is contained in the technical specifications?

The technical specifications are written instructions concerning project requirements that describe the quality of materials to be used and their performance.
3. What is the relationship between the working drawings and the technical specifications?

The working drawings usually contain information relative to design, location, dimensions, and construction of the project, while the technical specifications are a written supplement to the drawings and include detailed information pertaining to materials and workmanship.
4. How does the work involved in being an estimator for a general contractor differ from that of an estimator who works for a subcontractor?

The estimator for the general contractor is responsible for a detailed estimate for the whole project. They must compile costs on everything that is integrated into the project and put it together into a bid for the entire project. An estimator for a subcontractor will prepare an estimate only for the part

of the project for which they will be involved. For example they may be bidding only the masonry on the project.

5. What is the difference between doing a quantity takeoff and doing a full detailed estimate?

A quantity takeoff (QTO) is an estimate of the amount of in place materials required for the construction of a project. A full detailed estimate is an estimate that covers everything required for the construction of the project and includes both costs and quantities for materials, labor, and equipment and subcontractor costs.

6. What additional skills must the estimator have to be able to take a quantity survey and turn it into a detailed estimate?

- a. Be able, from looking at the drawings, to visualize the project through its various phases of construction.
- b. Have enough construction experience to possess a good knowledge of job conditions, including methods of handling materials on the job, the most economical methods of construction, and labor productivity.
- c. Have sufficient knowledge of labor operations and productivity to thus convert them into costs on a project.
- d. Be able to keep a database of information on costs of all kinds, including those of labor, material, project overhead, and equipment, as well as knowledge of the availability of all the required items.
- e. Be computer literate and know how to manipulate and build various databases and use spreadsheet programs and other estimating software.
- f. Be able to meet bid deadlines and still remain calm. Even in the rush of last-minute phone calls and the competitive feeling that seems to electrify the atmosphere just before the bids are due, estimators must “keep their cool.”
- g. Have good writing and presentation skills.

7. What is the difference between competitive and negotiated bidding?

Competitive bidding involves each contractor submitting a bid in competition with other contractors to build the project. In most cases the lowest bidder is awarded the contract to build the project as long as the bid form and proper procedures have been followed and the contractor is able to attain the required bonds and insurance. Negotiated bidding involves the contractor working with the owner (or through the owner's architect-engineer) to arrive at a mutually acceptable price for the construction of the project. It often involves negotiations back and forth on materials used, sizes, finishes, and other items which affect the price of the project.

8. What is the difference between a detailed estimate and a square-foot estimate?

The detailed estimate includes determination of the quantities and costs of everything required to complete the project. This includes the materials, labor, equipment, insurance, bonds, and overhead, as well as an estimate of profit. Square-foot estimates are prepared by multiplying the square footage of a building by a cost per square foot and then adjusting the price to compensate for differences in the building heights, length of the building perimeter, and other building components. Square-foot estimates require less information to prepare and are less accurate.

9. What are the contract documents, and why are they so important?

The contract documents consist of the invitation to bid, instructions to bidders, bid form, owner-contractor agreement, general conditions of the contract, supplementary general conditions, technical specifications, and the working drawings, including all addenda incorporated in the documents before their execution. All of these taken together form the contract. These documents provide the legal basis for the construction of the project.

10. Why is it important to bid only from a full set of contract documents?

It is important to bid from a full set of contract documents to be certain you have all of the required information. If part of the documents are missing that portion of the project would most likely be left out of the bid. Errors of omission can be catastrophic for a contractor.

11. For this assignment you will explore the role estimating plays in the construction industry by interviewing a person whose job duties include estimating. Begin by setting up an interview with an estimator, project manager, project engineer, superintendent, foreperson, architect, engineer, construction material salesperson, or freelance estimator. During the interview, ask the person the following questions and ask follow-up questions as necessary. Be respectful of their time and limit your interview to 20 minutes, unless the person offers to extend the interview. Be sure to thank the person before you leave and mail them a thank you note within 48 hours of the interview. After the interview, prepare written responses to the following questions and be prepared to discuss your findings in class, if your instructor chooses to do so:
- What are the estimates used for (ordering materials, preliminary budget, etc.)?
 - At what stage of the construction process (early-design, late-design, bidding, construction, etc.) does the estimate occur?
 - What are the consequences if the estimate is slightly wrong? If it is very wrong?
 - How do they prepare an estimate? After the interview, decide which estimating method (detailed, assembly, square-foot, parametric, model, or project comparison) best describes the type of estimates he or she prepared.
 - How long does it take to prepare an estimate?
 - What skills are required to become a good estimator?
 - What experience is required to get a job like his or hers?

The answers to these questions will vary from interviewee to interviewee.

12. Review a copy of the contract documents (drawings and project manual) for a construction project. Contract documents may be reviewed at a contractor's, subcontractor's, architect's, or engineer's office or may be downloaded from the Internet. Write a brief summary of how the contract documents are organized. Be sure to discuss both the project manual and the drawings. Be prepared to discuss your findings in class, if your instructor chooses to do so.

The answers to this question will vary from project to project.

13. Using the Warehouse.xls Excel file that accompanies this text, determine the estimated cost of a warehouse with the following parameters:

Building length—210 feet
Number of bays on the length side of the building—7 each
Building width—120 feet
Number of bays on the width of the building—4 each
Wall height above grade—22 feet
Depth to top of footing—12 inches
Floor slab—6 inches thick with wire mesh
Number of roof hatches—2 each
Number of personnel doors—4 each
Number of 14-foot-wide by 14-foot-high overhead doors—14 each
Number of 4-foot by 4-foot skylights—28 each

Fire sprinklers are not required
Separate male and female bathrooms are required

The estimated cost is \$1,137,495. See Problem 01-13.xlsx, which is available on the instructor's website.