

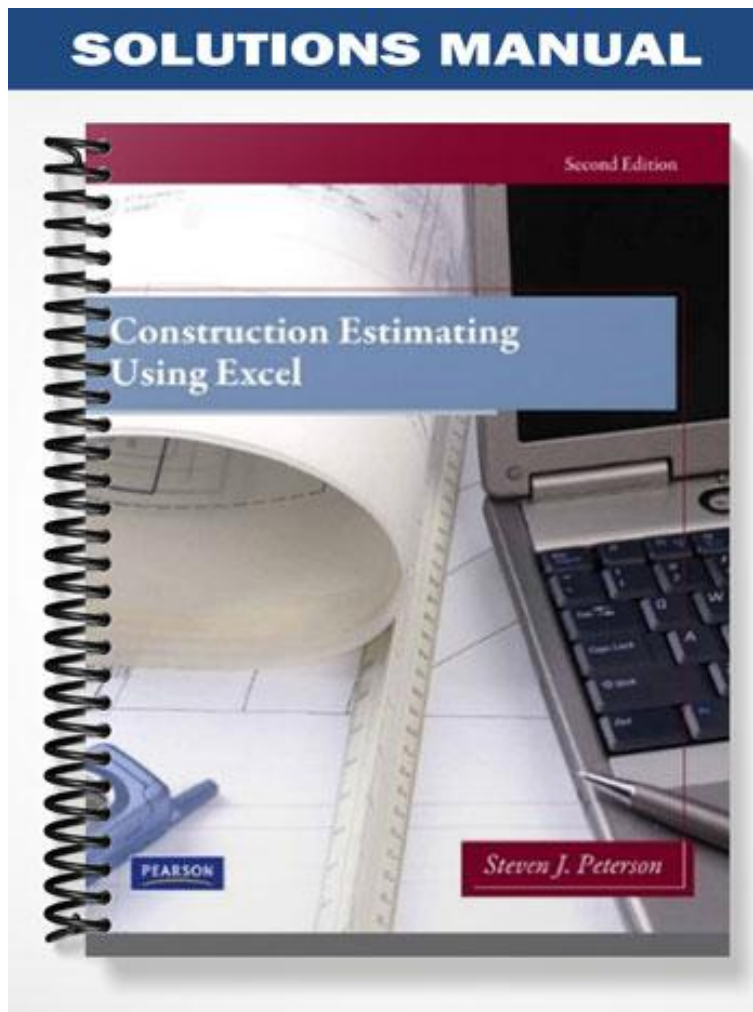
SOLUTIONS MANUAL

Second Edition

Construction Estimating Using Excel

PEARSON

Steven J. Peterson



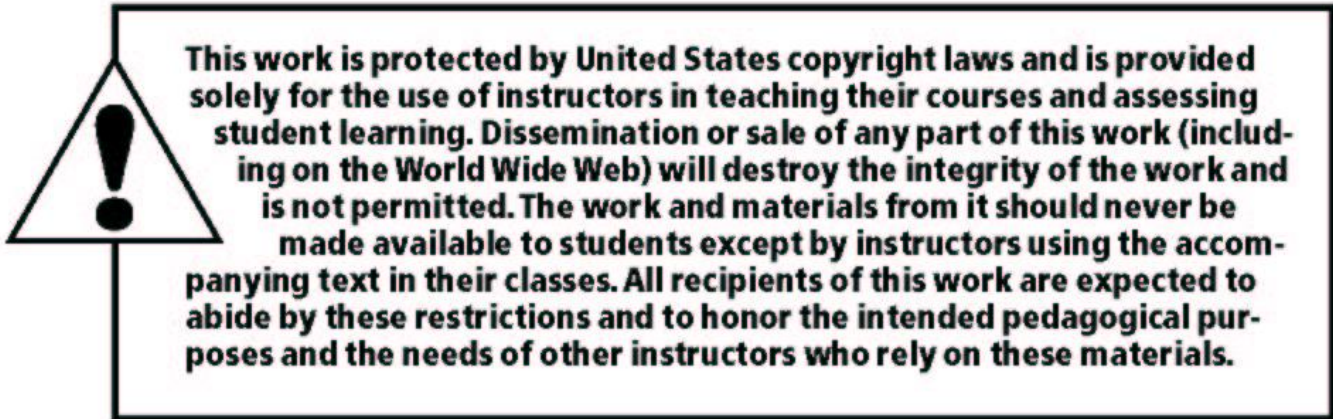
INSTRUCTOR'S MANUAL
to accompany

CONSTRUCTION ESTIMATING USING EXCEL
Second Edition

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INTRODUCTION TO THE INSTRUCTOR'S MANUAL

Welcome to the Instructor's Manual and companion files (IM Resource Files) to the second edition of *Construction Estimating using Excel*. This instructor's manual and IM Resource Files have been put together to help you get the most out of *Construction Estimating using Excel*.

The instructor's manual consists of a section for each of the 34 chapters in the textbook and a section for a computerized bid-day simulation called BidSim. The sections for each of the chapters contain (1) a list of learning objectives for the chapter, (2) instructional hints for the instructor, (3) potential activities that may be used in class or assigned to students to be completed out of class, (4) instructional resources, including the IM Resource Files and websites, which may be used as part of the classroom instruction, and (5) detailed solutions to the problems at the end of the chapters. The final section includes instruction on how to setup and run the BidSim game in your class.

The IM Resource Files contains the following items:

- AutoCAD Drawings from Chapters 5 through 18, which are found in the Drawings folder. These may be modified to create new estimating quantity takeoff problems for tests, quizzes, or practice exercises.
- The Excel files as they should appear at the completion of Chapters 3, 32, 33, and 34, which are found in the Excel Exercises folder. This allows the instructor to teach Chapter 32 without the students completing Chapter 3; and to teach Chapter 34 without the students completing Chapter 33.
- The Excel Test folder contains a test that may be given to students to assess their proficiency in setting up the Excel spreadsheets from the Excel Quick Tips of *Construction Estimating using Excel*. This test consists of having the students setup the Excel Quick Tips before class, bringing copies of the spreadsheets to class, entering the given data in the spreadsheets, and printing a copy of the spreadsheets. This test requires the students have access to a computer during the test. The folder consists of instruction to be given to the students before the assigned test and a sample test.
- PowerPoint slides for Chapters 1, 2, and 4 through 31, which are found in the PowerPoint Lectures folder and may be used as lectures or provided to the students as handouts to guide them through the key points of each chapter.
- Completed spreadsheets from the Excel Quick Tips, which are found in the Quick Tip folder. These may be used to demonstrate to the student how the spreadsheets should work when completed or they may be provided to students. Although, these spreadsheets may be provided to the students, the students will gain much needed experience by setting the spreadsheets up by themselves.

- Also included is a Word document (Equations.doc) containing all of the equations from *Construction Estimating using Excel*.
- Also included are Detail estimate sheets for the Johnson Residence (Johnson Residence Estimate.xls) and for the West Street Video (West Street Video Estimate.xls) whose plans are located in Appendix F of the textbook. They include the quantities, but not the pricing.
- **New:** Pdf versions of plans from Appendix F of the textbook for use with takeoff software packages such as On-Screen Takeoff.

To obtain these files please also download the corresponding files to accompany this Instructor's Manual found in the Instructor's Resource Center, under the same ISBN as this manual and titled, IM Resource Files.

Teaching Excel can be quite the challenge. In a classroom of students, one often finds the students range from novices with Excel to experienced users, from students who struggle to understand how to use the computer to students who catch on quickly. The challenge comes when the instructor has to teach this wide variety of students as a group, helping the novices and slow to catch on without having the experienced and quick to learn becoming bored. There are three approaches that may be used to teach the students Excel.

First, take the students step-by-step through the exercises in the Chapters 3, 32, 33, and 34. This only will work when all of the students are at the same level of experience with Excel and learn at a similar speed. If the group is not homogeneous, this method becomes very frustrating to the students and the instructor.

Second, demonstrate the key commands used in each chapter to the students and then let the students complete the exercises in the chapters on their own at their own pace. It is best if the students can complete the exercises during lab time when the instructor or a lab aid is available to answer their questions and help them solve any problems they encounter. This is the method I prefer when teaching Chapters 3, 32, 33, and 34.

Finally, have the students read and complete the exercise on their own. Like the second method, it is best if the students can do this in a supervised lab environment. This is the method I prefer when I have the students setup the Excel Quick Tips.

CONTENTS

Chapter 1: The Art of Estimating	1
Chapter 2: Overview of the Estimating and Bidding Process	3
Chapter 3: Introduction to Excel	5
Chapter 4: Fundamentals of the Quantity Takeoff	Error! Bookmark not defined.
Chapter 5: Concrete	Error! Bookmark not defined.
Chapter 6: Masonry	Error! Bookmark not defined.
Chapter 7: Metals	Error! Bookmark not defined.
Chapter 8: Woods, Plastics, and Composites	Error! Bookmark not defined.
Chapter 9: Thermal and Moisture Protection	Error! Bookmark not defined.
Chapter 10: Openings	Error! Bookmark not defined.
Chapter 11: Finishes	Error! Bookmark not defined.
Chapter 12: Fire Suppression	Error! Bookmark not defined.
Chapter 13: Plumbing	Error! Bookmark not defined.
Chapter 14: HVAC	Error! Bookmark not defined.
Chapter 15: Electrical	Error! Bookmark not defined.
Chapter 16: Earthwork	Error! Bookmark not defined.
Chapter 17: Exterior Improvements	Error! Bookmark not defined.
Chapter 18: Utilities	Error! Bookmark not defined.
Chapter 19: Material Pricing	Error! Bookmark not defined.
Chapter 20: Labor Productivity and Hours	Error! Bookmark not defined.

Chapter 21: Labor Rates	Error! Bookmark not defined.
Chapter 22: Equipment Costs.....	Error! Bookmark not defined.
Chapter 23: Crew Rates	Error! Bookmark not defined.
Chapter 24: Subcontract Pricing.....	Error! Bookmark not defined.
Chapter 25: Markups.....	Error! Bookmark not defined.
Chapter 26: Pricing Extensions.....	Error! Bookmark not defined.
Chapter 27: Avoiding Errors in Estimates ...	Error! Bookmark not defined.
Chapter 28: Submitting the Bid	Error! Bookmark not defined.
Chapter 29: Project Buyout.....	Error! Bookmark not defined.
Chapter 30: The Estimate as the Basis of the Schedule	Error! Bookmark not defined.
Chapter 31: Ethics.....	Error! Bookmark not defined.
Chapter 32: Converting Existing Forms	Error! Bookmark not defined.
Chapter 33: Creating New Forms	Error! Bookmark not defined.
Chapter 34: Proposals and Beyond.....	Error! Bookmark not defined.
Bidsim Game.....	Error! Bookmark not defined.

CHAPTER 1: THE ART OF ESTIMATING

LEARNING OBJECTIVES

At the completion of this chapter the student should be able to:

- Explain the role estimating plays in the success of a construction company.
- Identify what skills are needed to become a good estimator.
- Explain the role of the bid package in the estimating process.
- Identify the tools available to estimators.
- Explain why practice is important.

INSTRUCTIONAL HINTS

- One of the keys to motivating students to study estimating is for them to understand why it is important for them to develop estimating skills. Helping them understand that people other than estimators (such as foreperson, superintendents, and project managers) are often required to prepare estimates for materials, labor, and equipment. The lecture on this chapter should help students see why it is important to learn estimating.
- Estimating can only be learned by practice. The textbook contains hundreds of problems for the student to practice on. The lecture on this chapter should help students understand that to develop their estimating skills they need to complete the problems at the end of each chapter. Students should be encouraged to carefully review and work the example problems, including performing takeoffs on the garage drawings at the back of the book.

ACTIVITIES

- Invite a representative from industry to discuss the importance of estimating in the construction industry and the types of estimates different people prepare within their company.
- Have the students research and report on an estimating software or takeoff package. You may want to assign the students to report on a specific software.

INSTRUCTIONAL RESOURCES

- PowerPoint slide show: *PowerPoint Lectures\Chapter 01.ppt* from the IM Resource Files
- Information on MasterFormat: www.csinet.org

SOLUTIONS TO THE TEXTBOOK PROBLEMS

1. The process of determining the expected quantities and costs of the materials, labor, and equipment for a construction project.

2. “The construction and services required by the Contract Documents...and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor’s obligations” (*General Conditions of the Contract for Construction*, The American Institute of Architects, AIA Document A201-1997, p 9).
3. Accurate estimates are needed for a company to be successful in the bidding process, while maintaining a reasonable profit margin.
4. The estimator is the person responsible for preparing quantity takeoffs and cost estimates regardless of their job title.
5. An estimator must: have a sound understanding of the construction methods, materials, and the capacities of skilled labor; the basic skills needed to determine the quantities of materials, labor, and equipment necessary to complete a project; be a good communicator, both verbally and in writing; possess strong computer skills; be detailed oriented; have the confidence to quickly prepare takeoffs and make decisions under pressure; and have a desire for contestant improvement.
6. Estimating is an art, and like any art, you can only become good at it by practicing.
7. Estimates are prepared from bid packages. The bid package defines the scope of work for the construction project.
8. Architect’s and engineer’s scales, roller wheel, digitizer, calculator, paper forms, spreadsheets, estimating software packages, and takeoff software packages.
9. The advantages include the software is inexpensive, it is easily adapted to the styles and estimating procedures of the company, and it easily performs the mundane calculations. The disadvantage is it is less automated than an estimating software package.
10. The advantages include it automates many takeoff functions which decrease the time it takes to prepare an estimate, includes a database, can takeoff assemblies, and the takeoff is easily manipulated and printed in different formats. The disadvantages are it is expensive and takes a lot of time to setup and maintain the database.

CHAPTER 2: OVERVIEW OF THE ESTIMATING AND BIDDING PROCESS

LEARNING OBJECTIVES

At the completion of this chapter the student should be able to:

- Describe the steps taken to complete an estimate.
- Identify the general scope of work and the items which need to be bid to complete an estimate.

INSTRUCTIONAL HINTS

- During the lecture show how the different topics shown in Figure 2-1 relate to the chapters in the textbook. This will help them understand the organization of the course. The relationships are as follows:
 - Request subcontractor quotes: Chapter 24
 - Quantity takeoff: Chapters 4 – 18
 - Materials pricing: Chapter 19
 - Labor pricing: Chapters 20, 21, and 23
 - Equipment pricing: Chapter 22 and 23
 - Prepare bid documents: Chapter 28
 - Add markups: Chapter 25
 - Combine pricing: Chapter 26
 - Review bids for errors: Chapter 27
 - Submit the bid: Chapter 28
 - Project buyout: Chapter 29

ACTIVITIES

- Provide the students with copies of the Summary worksheet shown in Figure 2-2 and have them identify the items on the Summary worksheet which need to be bid to complete the bid for the Johnson Residence, the West Street Video, or another set of plans. Appendix B in *Construction Estimating using Excel* contains a list of items included in each of the codes on the Summary worksheet and should be used if a student is not sure where construction materials are located on the Summary worksheet.

INSTRUCTIONAL RESOURCES

- PowerPoint slide show: *PowerPoint Lectures\Chapter 02.ppt* from the IM Resource Files
- Summary worksheet: The Summary tab of *Excel Exercises\Chapter 32.xls* from the IM Resource Files
- Quantity takeoff for the Johnson Residence: *Johnson Residence Estimate.xls*
- Quantity takeoff for the West Street Video: *West Street Video Estimate.xls*

SOLUTIONS TO THE TEXTBOOK PROBLEMS

1. Get additional help, eliminate some of the estimating steps, or decide not to bid on the project.
2. It gives the surety time to prepare the bid bond, obtain the necessary signatures on the bond, and mail it to the contractor; thus eliminating the need to make a special trip to the surety's office to pick up the bond.
3. The subcontractor will need to find a time to come in, look at the plans and specifications, and prepare their estimate. When dealing with a limited number of plan sets, it can be quite a challenge to give all of the subcontractors a chance to look at the plans within the allowed time for the bid.
4. To ensure you have a bid for each category of work, rather than having multiple bids in one category and no bids in another category.
5. They carry the most risk should the contractor have to bid these items themselves.
6. Vendors often do not guarantee their quantities are accurate, and the estimator should prepare their own quantity survey to make sure there are sufficient quantities of materials to complete the work.
7. Mark blanks with Post-its[®].
8. To avoid missing items or having items included in the bid twice (for example, two subcontractors on the project have an item included in their bids).
9. Completeness of the scope of work, price, and past experience with the subcontractor.
10. Subcontractor or vendor contact information, project name, what they are bidding, any specific exclusions, if freight and sales tax are included, bid price, the date and time the bid was received, and who took the bid.
11. To avoid forgetting to get some of the necessary information.
12. Profit markup, overhead markup, building permit costs, bonding costs, and sales tax.
13. Company's overhead costs. The project specific overhead should be bid as part of the project costs.
14. The process of hiring subcontractors and procuring materials and equipment for the construction project.
15. During project buyout and the close-out audit

CHAPTER 3: INTRODUCTION TO EXCEL

LEARNING OBJECTIVES

At the completion of this chapter the student should be able to:

- Perform basic operations in Excel including: managing workbooks and worksheets, entering data, formatting worksheets and cells, creating headers and footers, and printing worksheets.
- Explain the difference between absolute and relative references.
- Use the ROUND, ROUNDUP, ROUNDDOWN, CEILING, FLOOR, SUM, AVERAGE, and IF functions.
- Explain how to test worksheets and why it is important.

INSTRUCTIONAL HINTS

- Tailor the lecture to the Excel experience level of your students. If most of your students have little experience with Excel, teach all of the topics in the chapter. If most of your students are experienced Excel users, teach the Order of Operation, the Absolute and Relative Reference, and the Basic Functions sections of the chapter.
- Teach the student to build the equations in steps. For example, have them build the nested IF statement used in Step 10 of Exercise 3-7 in two steps. First, setup and test the first IF statement as follows:

```
=IF(A10<A11,"Less Than","")
```

then add the second IF statement as follows:

```
=IF(A10<A11,"Less Than",IF(A10=A11,"Equal to","Greater Than"))
```

- Emphasize testing of spreadsheets under a variety of conditions. The students should make sure the spreadsheet works not only for the example but other situations as well.
- Be sure the students save a copy of the exercises in this chapter. Exercises 3-1 to 3-5 and 3-7 to 3-9 build upon each other. Exercise 3-1 must be completed before beginning Exercise 3-2, and so forth. The completed Exercise 3-9 will be used as the starting point for Chapter 32's exercises.

ACTIVITIES

- Have the students complete Exercises 3-1 to 3-9 in class. If the student does not have time to complete all of the exercises in class they should complete them as part of the homework. It is best if this can be done in a supervised lab.

INSTRUCTIONAL RESOURCES

- Completed spreadsheet for Exercises 3-1 to 3-5 and 3-7 to 3-9: *Excel Exercises\Chapter 3.xls* from the IM Resource Files.

SOLUTIONS TO THE TEXTBOOK PROBLEMS

1. A workbook is an Excel file. A worksheet is a page or division within the workbook. Worksheets are represented by the tabs at the bottom of the workbook.
2. (1) Clicking on the **Save** button on the Quick Access toolbar, (2) typing **Ctrl+S**, or (3) by selecting the **File** menu (the Microsoft Button for Excel 2007) and selecting **Save**.
3. (1) Clicking on the Insert Worksheet tab located to the right of the sheet tabs, (2) selecting the **Home** menu tab, selecting the arrow below the Insert button in the Style group, and selecting **Insert Sheet** from the popup menu, or (3) right clicking on the worksheet tab, selecting **Insert...** from the popup menu to bring up the Insert dialogue box, selecting **Worksheet**, and clicking on **OK** button.
4. (1) Right clicking on the worksheet tab and selecting **Move or Copy...** from the popup menu or (2) by selecting the **Home** menu tab, selecting the arrow below the Format button in the Cell group, and selecting **Move or Copy Sheet...** from the popup menu to bring up the Move or Copy dialogue box. From the Move or Copy dialogue box, the user checks the **Create a copy** check box and selects the location where the new sheet is to be inserted in the Before sheet: list box, and click on the **OK** button.
5. (1) By right clicking the tab of the worksheet to be renamed and selecting **Rename** from the popup menu, (2) by double clicking on the tab, or (3) by selecting the **Home** menu tab, selecting the arrow below the Format button in the Style group, and selecting **Rename Sheet** from the popup menu. The name of the tab will then be highlighted and can be edited.
6. The contents would return to Cell H15 and the user would have to use the cut command before pasting.
7. Place the cursor over the right side of a column's heading and hold down the left mouse button to drag the right side of the column to the desired width or double left click on the right side of the column's heading to have Excel automatically change the width of the column to the width necessary to show the data in the widest cell within the column.
8. The font may be changed from the Font tab of the Format Cells dialogue box, which is accessed by selecting the desired cells and performing one of the following actions: (1) by typing **Ctrl+1** and selecting the **Font** tab, (2) right clicking on one of the selected cells, selecting **Format Cells...** from the popup menu, and selecting the **Font** tab, or (3) selecting the **Home** menu tab and selecting the **Format Cells: Font** Dialogue Box Launcher located at the lower-right corner of the Font group. Alternately, the user may change the font from the Font Group on the Home tab.

9. Merges the selected cells together and centers the data in the cells.
10. Open the header for editing by clicking on the **Page Layout** button located on the Status bar or by clicking on the **View** menu tab and clicking on the **Page Layout** button in the Workbook Views group, selecting the header, and selecting Sheet Name from the Header & Footer Elements group of the Header & Footer Design tab.
11. Open the header for editing by clicking on the **Page Layout** button located on the Status bar or by clicking on the **View** menu tab and clicking on the **Page Layout** button in the Workbook Views group, selecting the header, and selecting Current Date from the Header & Footer Elements group of the Header & Footer Design tab.
12. Raise values to a power.
13. The steps are as follows:

Step	Procedure	Result
1	Raise 2 to the 5th power	$(32+4/2)*2-1$
2	Divide 4 by 2	$(32+2)*2-1$
3	Add 32 and 2	$(34)*2-1$
4	Multiply 34 by 2	68-1
5	Subtract 1 from 68	67

14. The values are as follows:

Cell	Value	Cell	Value	Cell	Value
B16	=\$B4	C16	=\$B4	D16	=\$B4
B17	=\$B5	C17	=\$B5	D17	=\$B5
B18	=\$B6	C18	=\$B6	D18	=\$B6

15. 120
16. 17.3
17. Error
18. Error
19. By clicking on the **Page Layout** menu tab, clicking on the **Print Titles** button in the Page Setup group to bring up the Sheet tab of the Page Setup Dialogue box, typing the beginning row followed by a colon followed by the ending row in the Rows to repeat at top: text box, and clicking on the **OK** button to close the Page Setup dialogue box.
20. Change the page breaks, the locations where one page stops and another begins, on the worksheet.

