

Solution Manual

for

Estimating Construction Costs

Sixth Edition

Prepared by

Garold D. Oberlender, Ph.D, P.E.

Carisa H. Ramming, P.E.

Contents

Chapter 1 – Introduction	4
Chapter 2 – Bid Documents	4

Chapter 3 – Estimating Process	6
Chapter 4 – Conceptual Cost Estimating	8
Chapter 5 – Cost of Construction Labor and Equipment	11
Chapter 6 – Handling and Transporting Material	21
Chapter 7 – Earthwork and Excavation	32
Chapter 8 – Highways and Pavements	46
Chapter 9 – Foundations	59
Chapter 10 – Concrete Structures	65
Chapter 11 – Steel Structures	74
Chapter 12 – Carpentry	76
Chapter 13 – Roofing and Flashing	84
Chapter 14 – Masonry	86
Chapter 15 – Floor Systems and Finishes	91
Chapter 16 – Painting	94
Chapter 17 – Plumbing	99
Chapter 18 – Electrical Wiring	104
Chapter 19 – Sewerage Systems	109
Chapter 20 – Water Distribution Systems	109
Chapter 21 – Total Cost of Engineering Projects	109
Chapter 22 – Computer Estimating	110

Introduction

This solution manual is intended as a guide for instructors using the textbook, *Estimating Construction Costs, 6th edition*. Estimating is not an exact science. It involves the process of forecasting the cost and/or time to perform construction operations based on assumed conditions. The assumed conditions include labor and equipment productivity, cost of materials, hourly rates of labor and equipment, and job conditions unique to each project.

Before assigning problems to the students, it is helpful for the instructor to first read the solutions contained in this manual, in particular the assumptions that are made in arriving at the final solutions. Obviously, different assumptions will produce different end results. For example, one estimator may assume a 45-min. effective hour, whereas another may assume a 50-min. effective hour. Similarly, one person may assume a 5% waste of materials, whereas another may assume 10% waste. Thus, the solutions to some of the problems appearing in this publication may differ from the solutions obtained by other persons, with both solutions being correct for the assumed conditions. For this reason the correctness of solutions to the problems should be based on the conditions assumed by the student and his or her mathematical solution of the stated problem.

Chapter 1 – Introduction

Chapter 1 has no homework problems

Chapter 2 – Bid Documents

2.1 Review the sections of *Instructions to Bidders* and *Bid Forms* in Division 00 in the appendix of the book and prepare a list of items the estimating team must address as they prepare a bid for the project.

Instructions to Bidders:

Receipt and opening of bids

Bid submissions

Withdrawal of bids

Bid Forms:

Base bid

Alternates

2.2 As discussed in this chapter the bid document becomes a legal document when the owner and contractor sign the contract agreement. Prepare a list of items that are in the bid documents that are no longer applicable when the contract is signed.

Advertisements for bid

Instruction to bidders

Bid form

Bid bond

2.3 Obtain copies and compare the general conditions of the contract from three sources: the American Institute of Architects (AIA), the Associated General Contractors (AGC), and the Engineers Joint Contract Documents Committee (EJCDC).

The answer to this question will vary, depending on depth of analysis by the student.

Responses will likely address emphasis on building type projects in the AIA and AGC document, and infrastructure type projects in the EJCDC documents, etc.

2.4 Obtain specifications from three sources: your local city government, your state department of transportation (DOT), and the American Association of State Transportation and Highway Officials (AASHTO). Summarize the list of major divisions of these three sources.

The answer to this question will vary, depending on depth of analysis by students. Local city government's pertain to commercial and residential buildings, city streets, water, and sewer type projects. AASHTO and DOT pertain to infrastructure type projects in the transportation industry.

2.5 Discuss problems that may arise during contract negotiations between the owner and contractor when the contractor's bid summary is by materials (such as concrete, metals, etc.), rather than by completed facilities (such as Building A, Building B, Parking Lot, etc).

The owner generally is interested in the cost of major components of the project, rather than the cost of construction materials. For example, if the estimated cost exceeds the owner's permissible budget, cuts must be made by eliminating a building, or parts of a building, rather than merely reducing the cubic yards of concrete or pounds of steel. Owners think in terms of facilities and sub-facilities, rather than materials that make up the

facilities. During negotiations, the contractor will likely have to reformat the estimate to enable the owner to make decisions on how to derive a contract amount that matches available funds.

2.6 List problems that may occur for the owner during the bidding phase of a project when the estimated pay quantities in a unit-price contract are lower than the actual amount.

The contractor may unbalance the bid by decreasing the unit price of the under estimated quantity and increasing the cost of another bid item, resulting in increased cost to the owner.

The contractor may underbid the job to win the contract, then look for change orders during construction to obtain additional money.

2.7 List problems that may occur for the contractor during construction when the actual quantity of work is lower than the pay quantities in the bid documents.

The reduced quantity of work may result in reduced profit for the contractor.

The contractor may have an excessive number of over-sized equipment on the job, resulting in reduced profit.

The contractor may file a claim against the owner, which will cause legal expenses.

2.8 Sometimes "Lump-Sum Contracts" are called "Hard-Dollar Contracts" or Fixed-Cost Contracts", which infers the bid amount will equal the final cost of the project. Prepare a list of methods a contractor may use to obtain costs above the bid amount.

The contractor may underbid the job to win the contract and then issue change orders for additional cost.

The contractor may file claims against the owner of the project.
