FOURTH EDITION

CONSTRUCTION JOBSITE MANAGEMENT

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Construction Jobsite management

Fourth Edition

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Dedication

To our fathers,
Ralph Mincks and Harold "Bud" Johnston,
who taught us that construction
is a respectable profession.

Contents

Preface

Construction Jobsite Management introduces students in two- and four-year construction management programs to all facets of construction project management from the contractor's point of view. This text examines the duties that are handled by the project manager, construction superintendent, and construction engineer throughout the progress of a job, from the configuration of a project team through project closeout. With a dedicated focus on the activities of jobsite personnel, this book shows students a wealth of helpful techniques and procedures for effectively managing projects from start to finish.

Construction today involves much more than the physical erection of a project. The contractor must systematically plan, organize, manage, control, and document jobsite activities. No margin for error exists on the jobsite in today's construction market; therefore, good organizational skills and the ability to anticipate problems are essential tools for effective jobsite managers. An efficiently managed jobsite should result in a profitable construction project. A good documentation system increases the manager's awareness of problems that develop early on in the construction process, which saves the effort and expense normally expended for claims and litigation. The current legal climate requires a detailed documentation of construction activities and events.

Approach and Organization

The procedures and methods contained in this book focus on the contractor's operation; however, many of these procedures and methods apply to owners' representatives, architects and engineers, specialty contractors, and construction managers as well. The methods herein are applicable primarily to commercial and industrial building construction, although many can be applied to all types of construction. Each project, depending on its size and specific attributes, will have different jobsite management needs. The constructor should use the procedures that will meet the needs of the project. Small projects normally consolidate several of the functions and activities detailed herein, but they nevertheless need the proper management to maintain profitability.

The five sequential, generally recognized phases of the construction process are predesign, design, bid/award, construction, and postconstruction. This book focuses primarily on the construction phase of the process, although other phases are discussed. The construction period begins after the contract for construction is awarded and includes preconstruction meetings and activities and the actual physical construction of the facility. This book also examines closeout and completion procedures after substantial completion, usually classified in the postconstruction phase. Additionally, jobsite management activities associated with project scheduling, project safety, contract documents, and building codes

are addressed; however, for a detailed look at these activities, numerous sources are available for further reference.

The project management system should meet project requirements and blend with company policy. The management system and organization should be designed to optimize efficiency at the jobsite but minimize direct overhead and labor costs. The contractor's primary goal during a construction project is to make a profit while satisfying contractual requirements. Thus, the main objective for a project management system is to facilitate the completion of a project as efficiently as possible.

This book addresses many of the methods involved in the management of construction jobsites. Each project, depending on its size, location, company policy, and contractual requirements, may use varying configurations of project management methods and structure. The contractor should evaluate each particular situation and use the proper tools accordingly. The procedures described in this book are illustrative rather than literal descriptions; however, they do not specifically apply to all situations on the jobsite.

Features of This Text

We wrote this text in clear, concise language to provide an essential introduction to the "real world" of effective management techniques. Several key features distinguish this text as a valuable resource for students and professionals:

- *Discussions* of current philosophies, procedures, and methods of management stress application over theory, making this book ready-made for use on the jobsite.
- *Hands-on experience:* The authors bring numerous years of actual construction project management experience to life so that concepts are immediately applicable to the real world.
- *Documents* used in project management are discussed, including the use of common forms such as AIA papers that can be directly applied to project situations.
- *Up-to-date information:* The chapters on safety and computerized project management are thoroughly up-to-date, keeping on pace with emerging technologies and jobsite conditions.
- *Review:* Chapter objectives and review questions reinforce concepts, and an Instructor's Manual with answers to the review questions is available on Cengage Learning's Instructor Companion Site.

New to the Fourth Edition

- Chapter 9 contains updates regarding Safety Factsheets, pedestrian safety around jobsites, the use of protective clothing, and accident reporting. A new Safety Inspection Checklist has been added, along with a full section on Environmental Protection and Safety.
- Chapter 13 is updated to reflect current processes for LEEDS commissioning throughout the stages of construction.
- Chapter 14 adds information on the dunning process, the use of cloud computing and Trimble for document management, updated advice on hardware requirements, and an all-new section discussing available mobile technologies and their advantages for jobsite management.
- An all-new Chapter 15 on Building Information Modeling (BIM) introduces the use of the BIM model from the design stage through post-construction, explaining the difference between two-dimensional construction documents and three-dimensional models and illuminating the advantages of BIM for the project owner.
- Example forms have been updated throughout.

Instructor Resources

Cengage Learning offers a robust suite of Instructor Resources to accompany *Construction Jobsite Management* at Cengage's Instructor Companion Site. With this unique resource, instructors can spend less time planning and more time teaching. The Instructor Companion Site includes the following:

- An *Instructor's Manual* containing instructional outlines and various resources for each chapter of the book, available in Adobe Acrobat® PDF format.
- Cengage Learning Testing Powered by Cognero. With hundreds of questions and different styles to choose from, instructors can create customized assessments for students and add unique questions and print rationales for easy class preparation.
- Customizable instructor support slide presentations in *PowerPoint*® format that focus on key points for each chapter.
- An *Image Gallery* to enhance instructor support slide presentations, insert art into test questions, or add visuals wherever you need them. These valuable images, which are pulled from the accompanying textbook, are organized by chapter.

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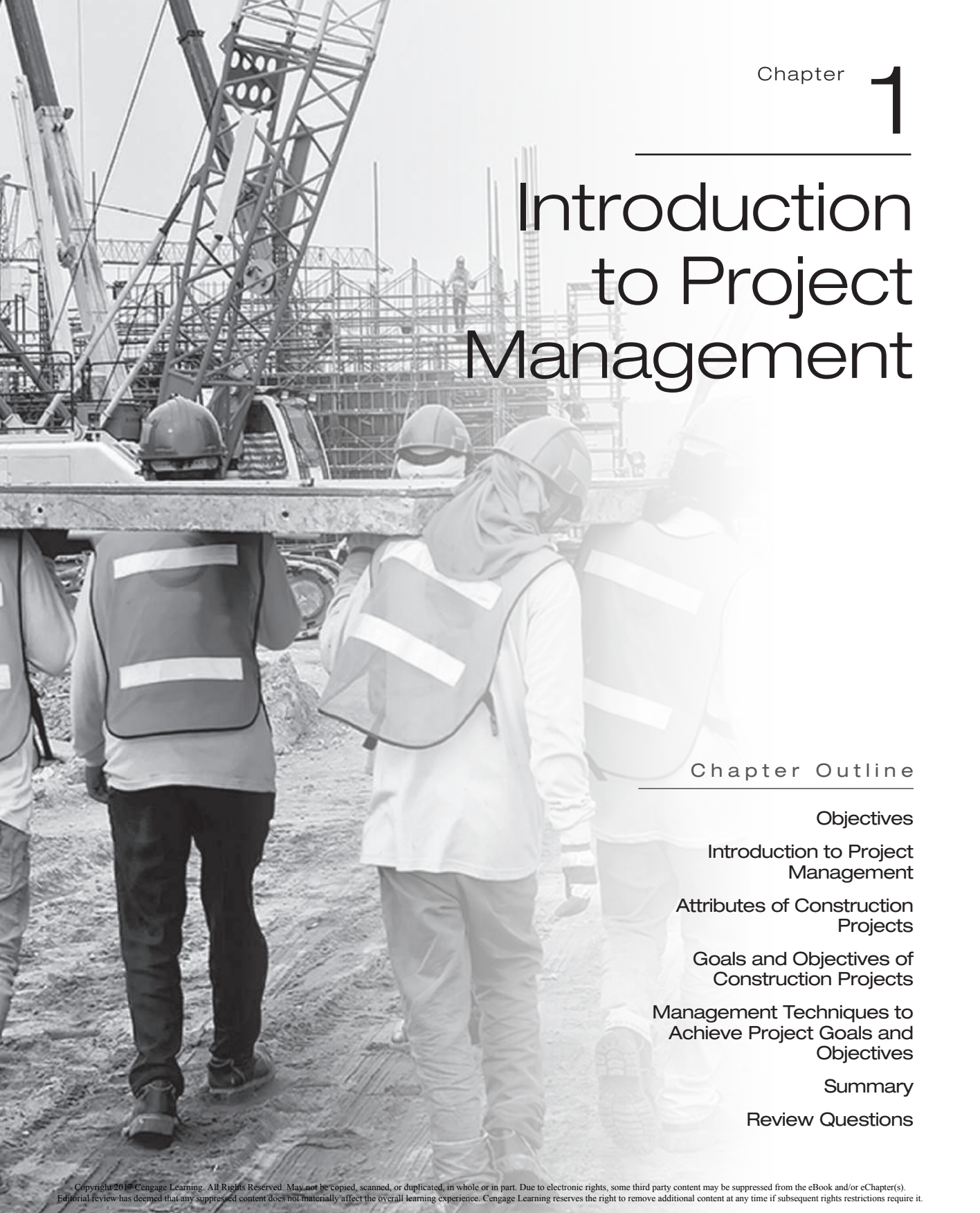
About the Authors

William R. Mincks is a Certified Professional Constructor (AIC) as well as a member of the AACE International. He has taught construction management at Washington State University, South Dakota State University, and Boise State University. He is experienced in many areas of construction and consults on project management, construction quality management, and housing issues.

Hal Johnston is a past Certified Professional Estimator (ASPE) for 30 years and is a licensed general contractor for the State of California. He is a Professor Emeritus of Construction Management at California Polytechnic State University, San Luis Obispo, California, and a Visiting Professor in the Department of Economics and Management, Civil Engineering, Czech Technical University in Prague (CVUT), the past four years and continues in that position.



Chapter 1

Introduction to Project Management

Chapter Outline

OBJECTIVES

This chapter introduces the theory of project management and the attributes of construction projects that require unique management. The objectives of this discussion are to present the following:

- Reasons for a different type of management for project-based firms
- Attributes of construction projects requiring special management techniques
- Goals and objectives of construction projects
- Management techniques that can be used to successfully meet the goals and objectives of construction projects

Introduction to Project Management

Management is a discipline that provides tools to direct people in pursuit of specific goals and is used to conduct efficient business organizations. The discipline of management is a large, broad-based field that encompasses all businesses and all business methods. Most management techniques can be adapted to most businesses, although in construction there are subsets of business conditions that require specialized techniques and a slightly different focus.

Project management is one such subset of the management discipline. It focuses on the management of several projects as separate entities rather than the whole business picture. In construction, these projects are also the profit centers for the company. Project management is also used in other types of businesses for a variety of purposes, such as the development of new products. Whatever the goals of the project, the project is managed by a key group of individuals focused on the project goals.

One of the prime characteristics of a project is its finite time frame, associated with a completion date. Under traditional business or manufacturing management, it is assumed that there is no completion date for the process. In project management, the specific techniques, management team, source of funding, and project emphasis conclude at the completion of the project. Each project usually has unique characteristics that require creative management and decision making, which end at the completion of the project.

As the characteristics of each project vary, the management approach must address each project separately and appropriately. The management team has a responsibility to achieve the project goals and to communicate with upper management. The overall management usually provides services to the projects, such as accounting, which can help tie all of the project operations together.

The primary purpose of the management team is to achieve the goals of the project. The goal of a construction project is to complete the project successfully, within the project parameters. "Successfully" usually means profitably, which is usually achieved with the appropriate quality and time frame. Construction firms are in business to make a profit that compensates the investment and ensures future continuation of the business. The goal of the project, then, is to make a profit as the project is assembled.

Attributes of Construction Projects

Construction projects have some particular attributes that set construction firms apart from other businesses. These attributes require special management attention, different from management activities in other firms. The management of construction projects requires a focus on solving problems as they develop during the project.

The following is a discussion of construction project attributes that require project management techniques:

- The construction project is a unique assembly with specific parameters, such as duration, quality, budget, assembly team, location, and other factors. Even a "cookie-cutter" house is a unique project with different site conditions, weather conditions, duration, subcontractors, and jobsite labor.
- The project will be completed within a finite duration; it has a specific start date and a specific completion date. Most projects have specific completion date requirements. Even large projects, which seem to continue forever, have specific completion milestones.
- The construction projects are usually located geographically away from company or corporate management. Whether down the street or on the other side of the world, the physical project is in a separate location from company offices.
- Separate management of each project is necessary. One project manager may direct several projects, but the management organization and techniques are specific to the needs of each project.
- Since each project has its own manager, there is a single source of responsibility to upper management for each project.
- The construction project is a separate cost accounting element, just as it is separated geographically and by its unique requirements. Each project's profits gauge the effectiveness of its management. The conclusions from project-based cost accounting directly relate to personnel decisions, operations methods, and the type of project that the contractor chooses to undertake in the future.

- There are thousands of parts, systems, and equipment within a single construction project. This complex assembly is purchased from many sources and differs from those in other projects.
- Substantial purchases and custom fabrications may be required for each project.
- Substantial subcontracting is used to construct the project. Some projects are 100 percent subcontracted. Commercial building projects are 70 to 95 percent subcontracted. Even where the contractor performs a large portion of the work, some subcontracting is included in the project.
- The construction project is usually not the only project under construction by the construction company. Most construction companies have numerous projects under construction at the same time, each requiring separate management.
- There is a single owner, or customer, for each project. There may be several layers of customers or users, but usually there is a single source of payment for the project.
- Each site is controlled by the contractor, including security and safety responsibilities at each site.

These attributes of the project, correlated with the goals of the construction firm for each project, will mold the techniques used to manage the project.

Goals and Objectives of Construction Projects

Each project will have some specific goals for the project to meet. As mentioned previously, the goal for the project may be that it is successful and profitable. "Successful" can mean many things, but generally it means that the project is complete within the time frame, the quality is acceptable, the customer is pleased with the project, and there is no continued active liability, such as lawsuits. "Profitable" generally means that the project produces at least the initially expected profit. As business growth is a typical goal for the overall company operations, increased productivity and the resulting increased profit are expected to be added to the estimated profit. In other words, "profitable" really means achievement of the optimum profit available for the project. Aggressive companies will set challenging goals for their projects or profit centers.

Objectives are definable tasks that support the goals. For a successful and profitable project, the objectives would be the following:

- Completion of the project within the specified or expected time frame. This is a gauge of success by the customer. If a project extends over the expected time frame, there usually are extended overhead costs such as a superintendent and jobsite facilities, which will also impact the profitability of the project.

- Completion of the project within the specified level of quality. Quality has several indicators:

  Material and equipment furnished to be of the specified parameters and to perform as expected.

  Workmanship is of the expected level. Generally, the customer does not like to notice evidence of the installation effort.

  Integration of all components to a complete package.

- Effective cost control to assure that project costs are under or meet the estimated costs for the project. This, of course, directly relates to the profitability of the project. Cost control is also an indicator of the productivity of the project and the effectiveness of the project management.
- Effectiveness of the jobsite safety program. Success of a project relates directly to the safety and well-being of the personnel working on the project. Accidents have a direct effect on the profitability of the project and the overall profitability of the company, both currently and in the future.
- Customer satisfaction. Customer satisfaction can be achieved by all of the previous objectives; however, it requires management attention in order to be achieved. Failure to satisfy the customer can result in delays in payment and the final completion of the project, and it also can hinder the company's ability to obtain future projects. Gaining customer satisfaction involves effective communications, salesmanship, and attention to detail, as well as completion of the physical project as expected.
- Effective management of subcontractors. Since subcontractors perform a substantial amount of the work on the jobsite, they need to be coordinated to ensure that they meet all of the previous objectives. If the subcontractors do not meet the previous objectives, the contractor will not either.
- The previous objectives are interrelated. If the project lags behind schedule, cost and quality are affected. If quality is not met with either materials or workmanship, the schedule and cost will be affected. If the safety of the project is not maintained, accidents can greatly affect the schedule, quality, and cost of the project.

Management Techniques to Achieve Project Goals and Objectives

The process of building a construction project does not necessarily assure that the goals and the objectives of the project are met. Management is necessary to control the building of the project in order to achieve the project objectives.

Professional constructors familiar with a wide variety of management techniques are necessary to bring projects within the goals and objectives in the current competitive market. The time when only a "master builder," an individual who understood how to assemble the building parts, was necessary for construction is gone. Our constructed facilities today are much too complex to be designed and built by one individual; it takes a team of design and construction professionals. Managers are necessary to build the project and to control all of the variables of the project.

The following is a brief discussion of the types of management techniques that can be used to help achieve the goals and objectives of a construction project. This book discusses these techniques in considerable detail.

Organization of the Project Delivery System

The organization of the management personnel on a project needs to be a cost-effective system in order to meet project requirements. Some projects will require more controls and more communication data, requiring more jobsite management personnel. There will be company organization policies assigning personnel to different areas of responsibilities and usually separate, flexible plans for project management.

Project management personnel can include project managers, superintendents, area or trade superintendents, field engineers, office engineers, and several other classifications. The type and quantity of jobsite personnel will vary because of many factors:

- Duration of the project (how quickly the owner needs the facility)
- Size of the project, usually indicated by the cost of the project
- Amount of self-performed work
- Personnel available, considering each individual's strengths
- Size of crews for the project
- Multiple areas of work
- Multiple contracts
- Reporting requirements to the customer
- Extent of cost control required by the company
- Amount of reporting and documentation required by the company
- Public versus private work (Normally public work requires more reporting and record keeping; however, some private clients require an extraordinary amount of record keeping)
- Type of contract

- Construction market, particularly on lump-sum projects. In tight construction markets, jobsite overhead is reduced and management tasks are consolidated

Although poor organization is not always recognizable as a cause for poor project performance, skillful organization of management personnel is essential in management practices. Therefore, the project organization needs to be carefully formulated during the planning process. Chapter 2, The Project Team, discusses organization forms commonly used in construction delivery systems.

Leadership

Remote projects are managed separately from business operations and require strong leadership from the management team. Leadership for strong management can influence the profitability of a project. Leadership abilities, whether an individual's or the entire project management team's, consist of the following attributes:

- Vision of the entire project and what needs to be achieved
- Plan for achieving the completed project
- Insistence that the project meet the intended financial goals with continual monitoring of costs
- Understanding of the crews and the motivation necessary to achieve the project goals
- Communication skills to facilitate progress of the work
- Maintaining a relationship with upper management to be able to control the project without interference
- Realizing that the timing of every decision is critical to the completion of the project
- Loyalty to the company and the project goals and realizing that personal achievement is accomplished through the company and project successes

Individual leadership qualities are hard to assess; however, the results of the project will reflect on the leadership skills of the management team. Leadership characteristics of construction jobsite management personnel are addressed throughout this book.

Problem Solving

Just as project managers encounter a unique set of individuals and work requirements on each project, they also find unique problems arising during the course of each project. Each problem needs to be solved immediately and correctly. Any delay in solving problems can result in work delays. This sounds easy, but

it is probably the main contributor to project delays and extra, unwarranted costs. The problems encountered in a construction project are usually complex, including several trades, subcontractors, and suppliers. Project management needs to analyze each situation and make the decision that has the least unfavorable impact to the project.

Some considerations that need to be recognized in project problem solving are the following:

- Full impact of the problem on subcontractors and suppliers, as well as to the contractor
- Cost impact of the problem, including responsibility for extra cost, minimal cost impact, and indirect costs
- Time impact of the problem, possibly resulting in a time extension and additional overhead compensation
- Best solution for project conditions, considering crew, environment, project progress, and customer needs
- Best method of resolving conflicts between project participants as quickly as possible

Problem-solving techniques are addressed throughout this book.

Reporting and Record Keeping

To jobsite personnel, reporting and record keeping may seem like a waste of time. These activities, however, are essential to project management systems. Reporting and record keeping provide the following:

- Communication between the field and home office
- Communication with the client and the client's consultants
- Systematic and regular analysis of current conditions by field personnel, providing a basis for problem solving
- Historical record for documentation of the project

Chapter 5, Documentation and Record Keeping at the Jobsite, looks at project record keeping in depth.

Planning and Scheduling

Planning and scheduling construction activities enables the project to complete on a finite date. The plan organizes the project, and the schedule is the tool for communicating the plan. The schedule communicates the plan to field personnel, home office personnel, the customer, the customer's consultants (architects and engineers), suppliers, and subcontractors. The schedule can be used

as a tool for duration control of the project, managing subcontractor work, problem solving on the job, and increasing jobsite productivity, as well as a means of communication. Plans and schedules are flexible; they can be modified to changing conditions. Initial planning of the project provides a basis for the management of the project, while continual planning and scheduling are necessary throughout the project to address conditions that arise during the project. Chapter 12, Time and Cost Control, covers some uses for the schedule in managing the project.

Cost Control

Cost control involves containing construction costs within the budget established by the cost estimate. Cost control is more than accurately reporting costs and comparing them to the estimate. It involves the use of the comparison to indicate a need to change methods, techniques, or crew composition to achieve the desired profit on the project. Cost and productivity control can help achieve additional profits on the construction project.

Collection of actual construction costs for work activities also ensures an accurate cost database for the construction contractor. The use of accurate, proven construction costs can help with the accuracy of estimates. Figure 1–1 shows the continual flow of information from estimating to actual cost to historical cost data.

Chapter 12 also examines some cost control techniques used by jobsite management.

Quality Management

Quality management has become an important part of project management's tasks. Quality has several meanings within the project context: meeting the expected level of material, maintaining the level of workmanship, and earning

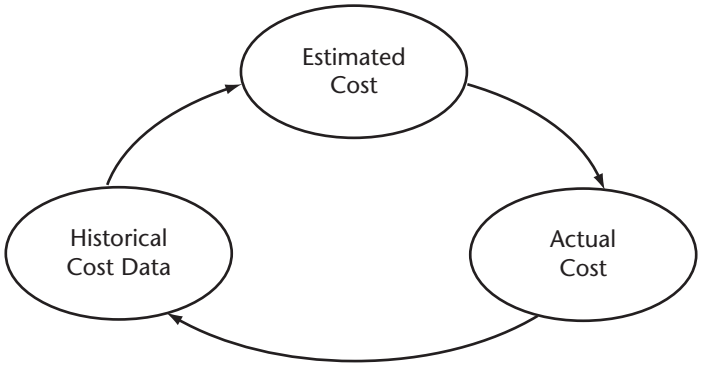


FIGURE 1–1 Flow of Cost Information