FOURTH EDITION

CONSTRUCTION JOBSITE MANAGEMENT

William R. Mincks Hal Johnston

Construction Jobsite management

Fourth Edition

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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.

Acknowledgments

The authors would like to thank our wives, Rena and Joy, for their patience, inspiration, and help in this undertaking. A special thanks to Joy Johnston for her work in obtaining permissions for material in this book.

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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.

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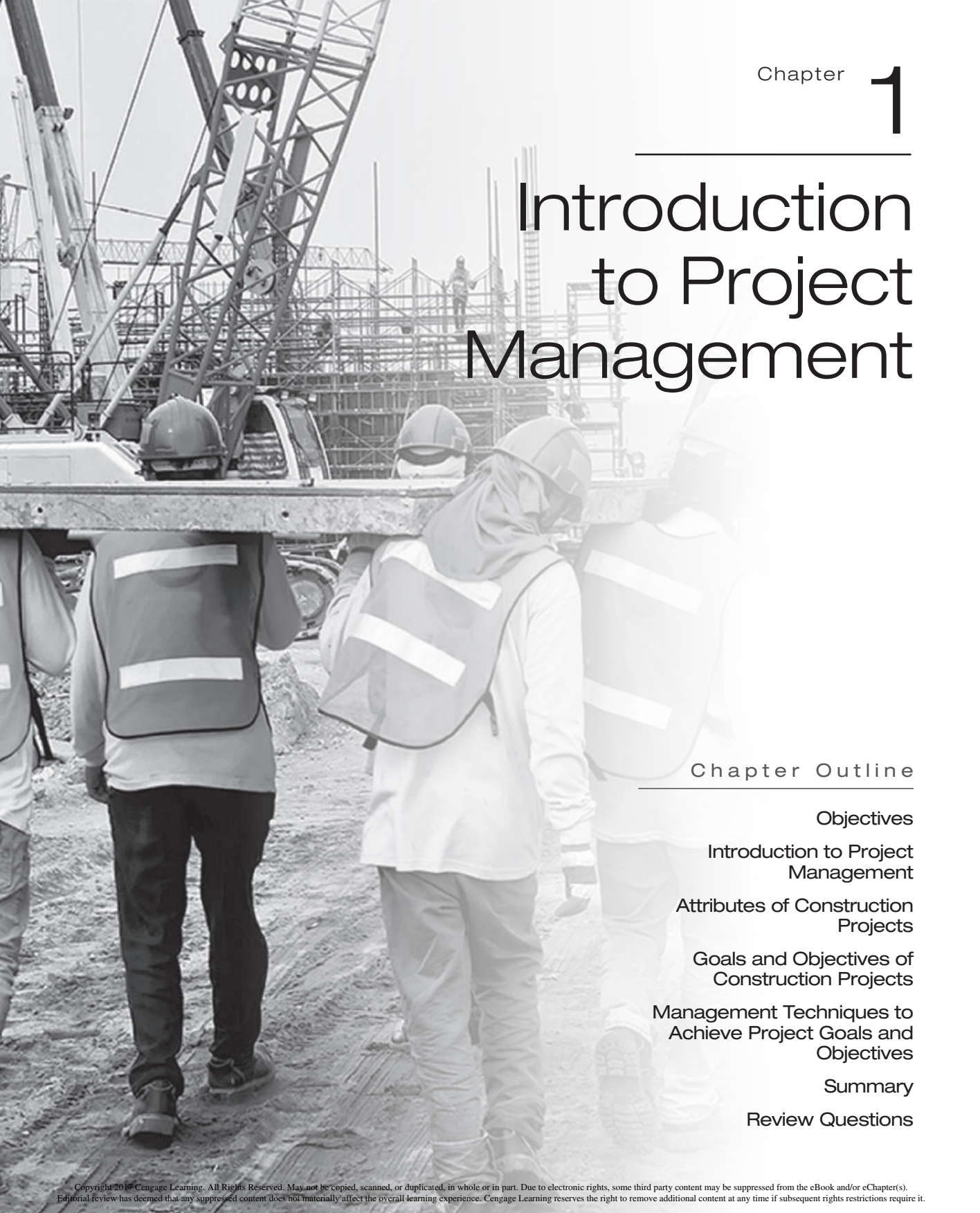


Chapter 1

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

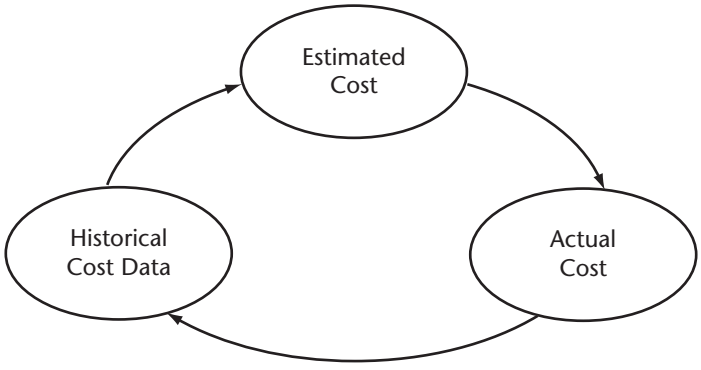


FIGURE 1–1 Flow of Cost Information

general customer satisfaction. As each project is unique and has many subcontracted portions, meticulous care is required to obtain proper results during the construction process. Subcontractor and trade coordination, inspection, and checklists facilitate achievement of quality in the project. Chapter 11, Project Quality Management, discusses project quality and the methods used to ensure quality in the project.

Safety Management

Most construction contractors are realizing the economic benefits of a proactive safety management program. Considerable savings can be made to workers' compensation premiums and insurance premiums by having a good safety experience rating. This is an instance where project costs often exceed the apparent immediate benefit to the project itself. The safety records for previous projects reflect on the rates paid for today's project. This is a tie between the individual project and company-wide performance. An effective project safety and accident prevention program reflects on the individual project, but it has an even greater effect on the company-wide performance record.

Safety management is characterized by the implementation of safety plans, the application of safety procedures and proper equipment in work tasks, the encouragement of jobsite safety meetings, the provision of appropriate protective equipment, and the management of potentially hazardous substances on the jobsite. The goal of safety management is to prevent all accidents at the jobsite. Chapter 8, Jobsite Labor Relations and Control, deals with safety management.

Contract Compliance

Most construction projects have numerous requirements and procedures that must be met. A wide variety of submittals needs to be made to the client during the course of construction:

- Material and permanent equipment submittals (Chapter 3, Use of Construction Documents on a Jobsite)
- Shop drawings for project-specific material fabrications (Chapter 3, Use of Construction Documents on a Jobsite)
- Project meetings (Chapter 6, Jobsite Layout and Control)
- Change control, documentation, and compensation (Chapter 18, Project Closeout)
- Progress payments (Chapter 16, Changes and Claims)
- Project closeout (Chapter 17, Progress Payments)

Computerized Record Keeping

Computerized record keeping helps the project manager to compile, organize, and analyze information about the progress of the project. Time, cost, and project data are recorded by computers on the jobsite. The timely production of quality, usable information facilitates problem solving and communication during the project. Chapter 12, Time and Cost Control, addresses current uses of computer technology in jobsite management.

SUMMARY

Construction organizations rely on project management to manage their profit centers because the source of their profit-making activity is at temporary sites, remote from the home office. Construction projects have unique attributes that require a different emphasis in management style. The goals of a construction project are for it to be successful and profitable. Success may relate to many different factors, but usually it relates to on-time completion, achieving acceptable quality, and satisfying the customer without lingering disputes. Profitability is achieving at least the expected profit from the project. Computers are now a necessary component of project management. They quickly record, track, and distribute documents to the key people involved in the construction project.

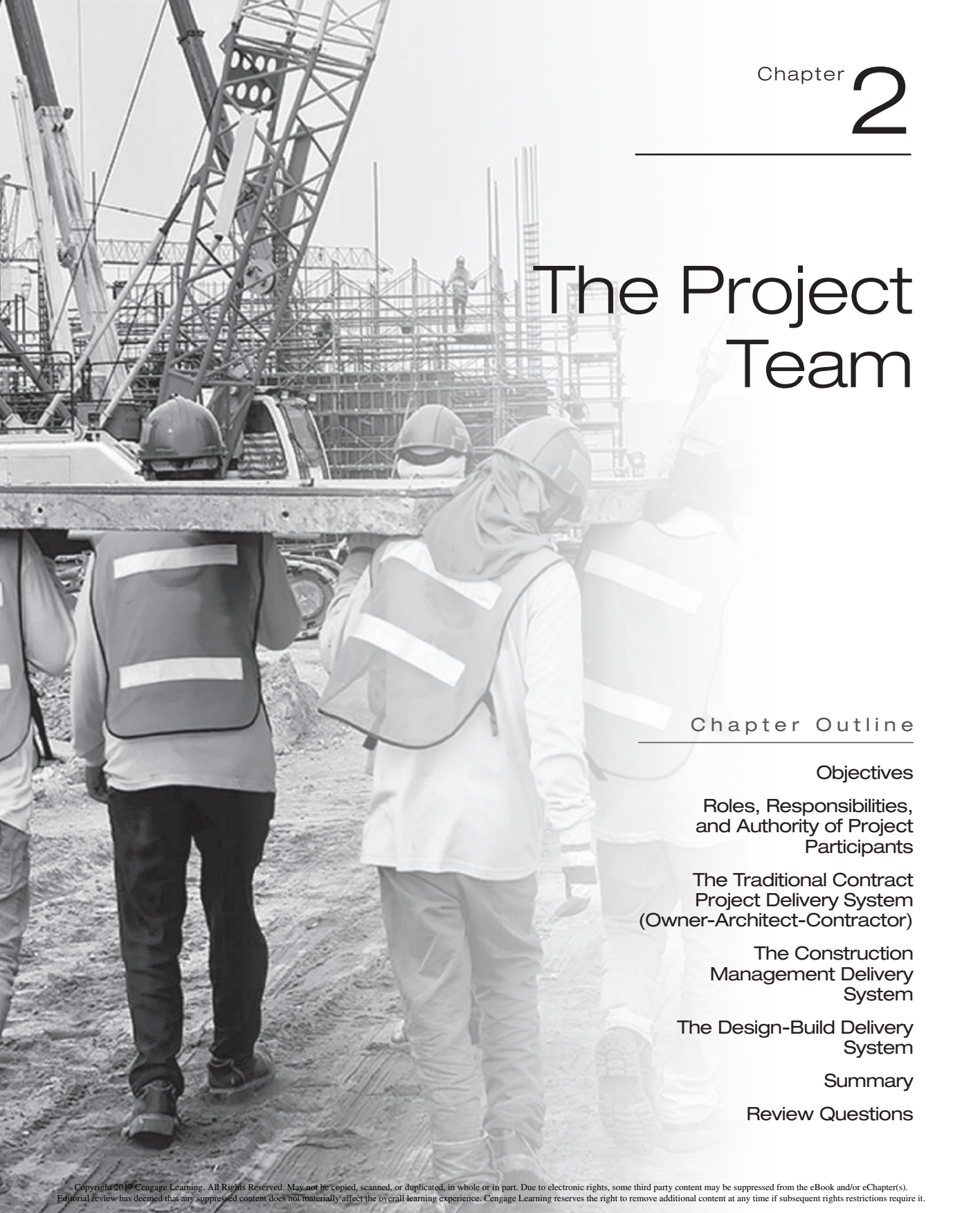
To obtain the goals and objectives of the project, the project team needs to use a variety of techniques:

- Organization of the project delivery system
- Leadership, from the very start of the project through its completion
- Problem solving
- Computerized reporting and record keeping to facilitate the construction process
- Planning and scheduling
- Cost control
- Quality management
- Safety management
- Contract compliance

This text discusses all of these items to facilitate the successful completion of construction projects.

REVIEW QUESTIONS

1. **What are five attributes of construction projects that require project management techniques?**
2. **Compare a manufacturing firm, in a single location with a single product, to a construction firm with several projects. What are the primary differences between these firms? Why is a different management approach needed for each firm?**
3. **What are the typical goals of a construction project?**
4. **Discuss the purpose of five techniques used in project management. Describe how these techniques help managers achieve the goals mentioned in the previous questions.**



Chapter 2

The Project Team

Chapter Outline

OBJECTIVES

This chapter discusses common construction delivery systems and the roles within those systems. The objectives of this chapter are to introduce the following:

- Traditional delivery system and the relative roles within that system
- Roles and responsibilities of the participants in the traditional system for the owner, architect, and contractor
- Construction management form of the construction delivery system and the relationships of the roles within that system
- Design-build delivery system with examples of the roles and responsibilities within that system

Roles, Responsibilities, and Authority of Project Participants

There are many ways to structure a construction project. The ***delivery systems*** provide a matrix of organization, with formal and informal contractual relationships between participants. Participants are assigned certain specific responsibilities within their contracts. Standard contractual forms are available for each delivery system, using generally uniform terminology and defining the roles and responsibilities for participants. Professional and trade associations produce and endorse contractual agreements that are widely used throughout the construction industry. The American Institute of Architects (AIA) publishes a complete set of contractual documents, including architect and contractor agreements. The Engineers Joint Contract Documents Committee has produced a set of contract documents that is primarily used in engineering construction. The Associated General Contractors of America, Inc. (AGC) also produces a set of contractual documents that includes agreements between contractors and owners and between contractors and subcontractors. The Design-Build Institute of America has developed contract documents including agreements between the owner and the design-build firm. ConsensusDocs also provides a complete set of contract documents, which are used extensively. Owners who use any of these forms can supplement and modify the standard contract with specific clauses relating to their particular needs. Public agencies such as municipalities, states, and the federal government have custom contract forms that meet the contracting regulations that are legislated specifically for them.

This chapter examines three basic project delivery systems:

- Traditional system
- Construction management
- Design-build

There are many variations and hybrid combinations of these three basic systems. Basic roles will be defined that can be used as a standard; however, these roles will change as the delivery system changes.

The Traditional Contract Project Delivery System (Owner-Architect-Contractor)

The traditional project delivery system, also frequently referred to as "design-bid-build," has been the most used project delivery system since the late 1800s. The legal separation between design professionals and construction forces was created by the Miller Act of 1935. This law required the contractor on federal construction projects in excess of $100,000 to post both a performance bond and a labor and material payment bond. Prior to the middle of the nineteenth century, the most common project delivery system was through a master builder.

The traditional system has three primary contractual parties:

- The owner
- The architect
- The contractor

The owner and the architect execute a contract for applicable studies, design, production of construction documents, and administration of the construction process at the beginning of the project process. The AIA agreement between the owner and the architect is AIA Form B-141. The owner and the contractor execute a contract for the construction of the project, according to the construction documents prepared by the architect, after the design and construction documents are completed. The architect then administers the contract as an agent of the owner. There is no direct contractual relationship between the architect and the contractor, but an indirect relationship exists because the architect is acting as the agent of the owner during the construction phase of the project.

Since neither the architect nor the contractor actually does 100 percent of the work assigned to their own forces, each party makes an agreement with the other business firms involved to accomplish specific areas of the work assigned under their contract. The architect will normally utilize the services of professional consultants, referred to as sub-consultants within the contract matrix, such

as civil and environmental engineers, structural engineers, mechanical engineers, electrical engineers, and several other specialties contained within the project. These sub-consultants have an agreement (AIA Form C-141) with and provide specific services for the architect. There is no contractual relationship between the sub-consultant and the owner. The architect is responsible to the owner for the competent completion of his work, including work performed by the sub-consultant. For example, if the structural engineer made a serious error in the design of the structural members of the roof, resulting in the roof's collapse, the owner would seek relief from the architect as the responsible party because the owner and the architect have an agreement that requires competent design of the entire project. The architect would then subrogate the claim to the structural engineer, who was contracted by the architect to design the roof system.

In building construction, much of the work is accomplished by specialty contractors who have an agreement with the contractor to complete a specific portion of the work covered by the contractor's contract requirements. This subcontract agreement details specific responsibilities of the work, with requirements added by the contractor. The subcontract agreement is between the contractor and the subcontractor. A common type of this contract is AGC Form 600; however, many contractors have their own standard subcontract agreement. Like the architect and sub-consultant relationship, there is no direct contractual relationship between the subcontractor and the owner. The contractor is responsible to the owner for complete compliance to the contract documents despite the fact that portions of the work have been subcontracted. If in the previous example the roof structure was improperly installed by the subcontractor, the owner would seek relief from the contractor for repair and for relief of damages. The contractor would in turn look to the subcontractor for repair and damages appropriate to the subcontract agreement.

Figure 2–1 illustrates the relationships between parties in the traditional delivery system. Note that the heavy dark lines indicate a ***direct relationship***,

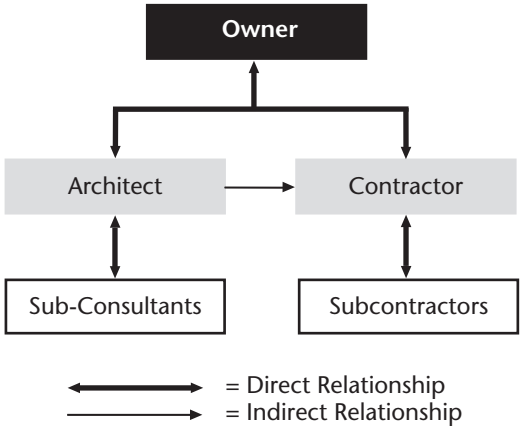


FIGURE 2–1 The Traditional Construction Delivery System

also known as ***privity of contract***, and the light line represents an ***indirect relationship***, also known as an ***agency relationship***.

The traditional contract delivery system is not always the best delivery system for every situation. It is, however, the most prevalent of the delivery systems in the building construction industry and is used on every size contract by both private and public owners. Other delivery systems, such as construction management or design-build, are growing in use, but the traditional system is still used by the majority of owners for their construction projects.

There are several methods of compensating the contractor for work completed:

- Lump-sum contract: This is the most common method, where the contractor gives the owner a lump-sum price to complete the project according to the contract documents, which include the contract provisions, drawings, and technical specifications. Changes to the scope of work are accomplished through change orders, which adjust the lump-sum amount during the construction period. The contractor is normally paid on a monthly basis during the construction period for the work installed and for the materials furnished during the month.

- Cost, plus a fee: In some cases, usually when the scope of the work is difficult to define, the contractor is reimbursed for costs on the project, plus a fee that includes indirect overhead and profit. "Costs" normally refer to labor, material, equipment, subcontracts, and direct (on-site) overhead. This method of payment is often referred to as "cost plus" or "time and material."

- Cost plus, with a guaranteed maximum price: This method of compensation for the construction contract is a hybrid of the lump-sum and cost plus contracts. This method is commonly referred to as guaranteed maximum price, or GMP. In this method, the contractor quotes a maximum price for the scope of work and proceeds on a cost-plus-a-fee for the project, often with an arrangement to split the savings between the contractor and the owner.

- Unit price contract: This method lists quantities for components of the project, which are priced per unit by the contractor. The total of the product of the quantity and the unit price is then added to determine the lump-sum price for the bid. Payment is based on the completion of the quantities for each line item. Unit-price contracts are not common in the building construction industry but are quite common in civil engineering projects.

Responsibilities of the Contractual Parties

The responsibilities of the three contractual parties—the owner, the architect, and the contractor—should be well defined by the contract. A brief summary of the common responsibilities of the participants in the traditional delivery

system is discussed next. (Refer to the AIA or AGC agreement forms for a complete definition of the responsibilities of each party.)

THE OWNER

The owner is responsible for paying for the work contracted to the architect and to the contractor. He is responsible to the contractor for providing coordination of the project, whether through an architect, an in-house representative, a project manager, or a "clerk of the works." The owner also provides the site for the project, provides the architect with whatever one needs, and may determine the scope of the project. Additionally, the owner provides the contractor with documents that adequately describe what the project will entail.

THE ARCHITECT

The architect normally provides the owner with the design of the project and the construction documents, based on the owner's needs. The architect is often engaged in providing construction administration for the project, acting as the owner's agent. The architect also provides interpretation of the contract documents.

THE CONTRACTOR

The contractor is responsible for providing the labor, material, equipment, and expertise to complete the project, as indicated by the documents furnished by the owner, for compensation as stipulated. The contractor is responsible for developing the means and methods of accomplishing the work, including sequencing, labor plan, equipment usage, and schedule. The contractor also is responsible for coordinating the work, including hiring the subcontractors, and paying for all labor, material, and subcontracts contained within the work.

During the actual construction of the project, a number of participants are involved, each having several different roles in the process. The following list describes the major parties that are involved in the construction phase of a project:

Owner	**Architect**
Capital Projects Officer	Principal-in-Charge
Financial Officer	Project Manager
Owner's Representative	Project Architect
Owner's Inspector	Contract Administrator
Testing Agency	Sub-Consultants
	Specialty Coordinators
	—Project Coordinator
	—Mechanical Coordinator
	—Electrical Coordinator

Contractor	Other
Officer-in-Charge Project Manager Superintendent Project Engineer Field Engineer Foremen Craftspeople Subcontractors —Foremen —Craftspeople	Building Inspector Plumbing Inspector Electrical Inspector Fire Marshal Elevator Inspector Safety Inspector

The Owner's Roles During the Construction Phase

The structure of the construction project in the owner's organization will vary greatly, depending upon the size of the project and the level of involvement in managing the project. The portion of an owner's organization chart that deals with capital projects may be similar to the one shown in Figure 2–2, which illustrates some of the roles in the owner's organization that are involved in the construction process.

CAPITAL PROJECTS OFFICER

The capital projects officer is the individual responsible to the owners and/or stockholders of the company for the project. This position may be filled by the owner of the company, the chief executive officer (CEO), the president, the vice president in charge of capital projects, the facility manager, or several other responsible

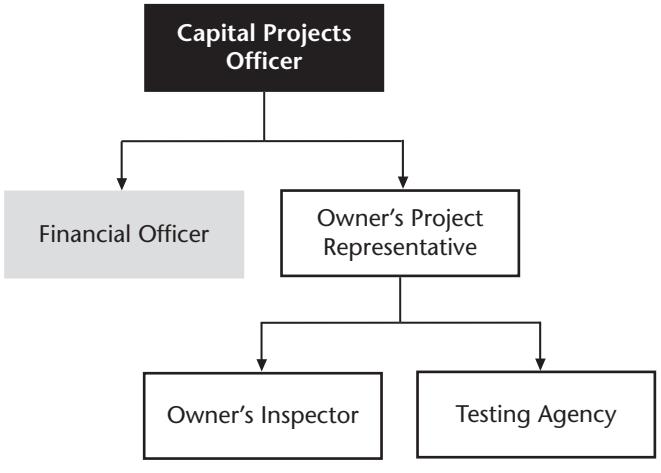


FIGURE 2–2 The Owner's Organization for the Construction Project

people. This person normally is involved at the inception of the project but may not intimately participate in day-to-day construction activities. He authorizes major changes and oversees the construction phase on a periodic basis.

FINANCIAL OFFICER

The financial officer for the owner is concerned primarily with the disbursement of funds for the project. As monies for payment of construction activities usually come from sources other than operating funds, the financial officer must anticipate and plan for the financial needs of the project, or what is commonly referred to as project cash flow management. The contractor provides the financial officer with a cash flow projection, which relates the project's schedule of values to the construction schedule.

OWNER'S REPRESENTATIVE

The owner's representative, sometimes referred to as the owner's project manager, is the owner's daily representative during the construction project. This individual may perform other responsibilities for the owner but is the owner's prime contact for the architect and the contractor. The owner's representative conducts business with the project managers for the architect and the contractor and will be the conduit of information between the architect and the owner's ultimate decision maker, the capital projects officer, and should be knowledgeable about construction practices. For owners who do not have continuous construction programs, the owner's representative is often a trained construction professional who may be hired solely for the project's duration.

OWNER'S INSPECTOR

The owner's inspector, sometimes referred to as the clerk of the works, is an individual who reports to the owner's representative. This person observes the construction process and documents the progress and the problems encountered and is normally concerned with the quality of the construction work as it is installed and with transmitting information on any deviations to the architect and to the owner's representative. The inspector has no authority to direct craftspeople, subcontractors, or the contractor to stop work. Such direction will come from the owner's or architect's representative. Depending upon the conditions of the project, the owner's inspector may be on the jobsite full-time or part-time. Or the owner may decide not to have an inspector on the project at all, relying instead on an inspection by the architect.

TESTING AGENCY

An outside testing agency is often contracted by the owner to perform certain quality control tests to verify that the materials are installed to the specified standards. Some of these tests might include soil compaction tests, concrete strength tests, reinforcing steel placement inspections, weld inspections, and

bolt-torque inspections. The testing agency is contracted by the owner, and its reports are directed to the owner, with copies normally sent to the architect and contractor. The owner can transfer the responsibility for testing to the contractor in the contract documents.

THE ARCHITECT'S ROLES DURING THE CONSTRUCTION PHASE

The complexity of the architect's organization is dependent upon the size of the architectural firm and the size of the construction process. Some architectural firms will combine the roles of project manager, project architect, and contract administrator, relying on one individual to perform all of these roles during the process. Figure 2–3 depicts an organizational strategy for an architectural firm.

PRINCIPAL-IN-CHARGE

The principal-in-charge is an upper-management-level individual who is the ultimate decision maker for the firm on the project. The individual could be the owner of the firm, the CEO, the president, or one of the principals. The principal-in-charge usually has been involved in obtaining the contract for the architectural firm. A business relationship exists between the principal-in-charge and the capital projects officer in the owner's organization. Like the capital projects officer, the principal-in-charge is not involved in the project during the construction phase on a daily basis and limits his participation to major issues only. The principal-in-charge, however, maintains high-level communication between the architect and the owner.

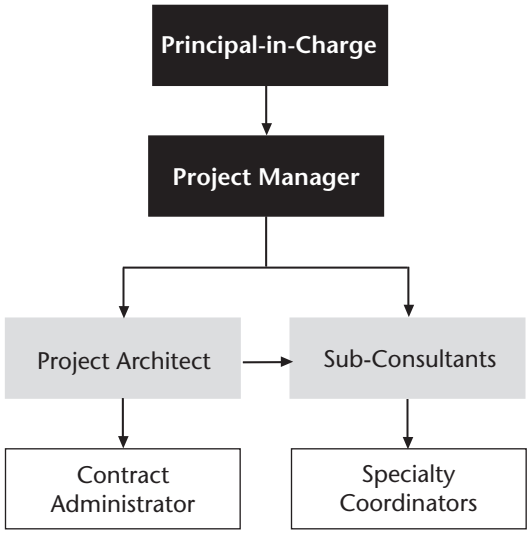


FIGURE 2–3 Architect's Organization

PROJECT MANAGER

The project manager is in charge of the project from beginning to end. This person may be working concurrently on other projects but is still fully responsible for each one. The project manager is the architect's primary contact with the owner's representative. He provides direction to the architect's other employees and to the sub-consultants who are working on the project. The architect's project manager is also the direct liaison with the contractor's project manager and is concerned with the project budget and with the costs incurred by the architectural firm. The project manager is responsible for the architect's team composition and its ability to fulfill its contractual obligations. This person will be involved in all of the decisions concerning changes in the construction contract and in evaluating the validity of those changes to the project.

PROJECT ARCHITECT

The project architect is involved primarily in the design of the project and construction documents. This person coordinates the designers, architects, engineers, draftspeople, specification writers, and sub-consultants in the process that ultimately produces the construction documents. By being involved in this process from the project's inception, the project architect is considered the expert regarding the intent and interpretation of the contract documents for the architectural firm but does not participate on a daily basis in the construction process. The project architect is probably the best source for the review of shop drawings for the project, if time allows. This person can also serve as a reference if other parties are to review the shop drawings. Some architectural firms do not have a contract administrator in their organization but instead utilize the project architect as the liaison during the construction phase. In that case, the contract administrator's duties, explained next, would be the responsibility of the project architect.

CONTRACT ADMINISTRATOR

Many architectural firms employ a contract or construction administrator who is a specialist in projects that are under construction. The contract administrator processes shop drawings, progress payments, requests for information, change orders, and correspondence relating to the project. This person also conducts meetings with the contractor and issues minutes of the meetings. The contract administrator is the primary day-to-day contact for the contractor's project manager and superintendent and observes construction and relates information about the project to the project manager. The contract administrator may also be responsible for making certain decisions on the project, depending upon the level of involvement of the architect's project manager during the construction phase.

Some architectural firms have an inspector on the jobsite at all times. This inspector is a clerk of the works who fulfills the duties of the owner's

inspector, described earlier. On projects that require a full-time inspector, this person is employed by either the architectural firm or the owner but usually not by both.

SUB-CONSULTANTS

The sub-consultants provide design services and portions of the construction documents that are not provided by the architect's in-house staff. Typical sub-consultants used on a building project include civil and environmental engineering, structural engineering, mechanical engineering, electrical engineering, and interior design firms. Other specialty sub-consultants, such as acoustical, kitchen, detention, and industrial engineering services, also may be used, depending on the specifics of the project. During the construction phase, the sub-consultant reviews shop drawings and provides input relevant to one's portion of the project to the architect and to the contractor (through the architect). Most sub-consultants retain some involvement during the project, usually relating to special installations that are needed to execute the work and approve the installation at its completion.

SPECIALTY COORDINATORS

The specialty coordinators are inspectors and engineers hired by the sub-consultants who provide services on the jobsite during the construction phase. As many of the specialty areas, such as mechanical and electrical, are extremely complex and relate to the work of many trades, the specialty coordinator can facilitate the work by becoming frequently involved in the project. These specialists often are intimately involved in equipment start-up and testing.

The Contractor's Roles During the Construction Phase

The organizational chart presented in Figure 2–4 indicates the typical hierarchy of the contractor's organization for the construction of the project. This arrangement may vary, depending upon the project's size, the special characteristics of the project, and the management philosophy of the construction firm. Some firms prefer to maintain a strong management presence on the jobsite, while others prefer to keep management to the minimum.

OFFICER-IN-CHARGE

The officer-in-charge, like the owner and the architect, is responsible for the firm's performance. This individual may be the construction company's owner, president, CEO, vice president, or district manager. This person has a business-level relationship with the owner's capital projects officer and the architect's principal-in-charge. The officer-in-charge normally is not involved with the project on a daily basis but is involved in matters that affect the success of the project.

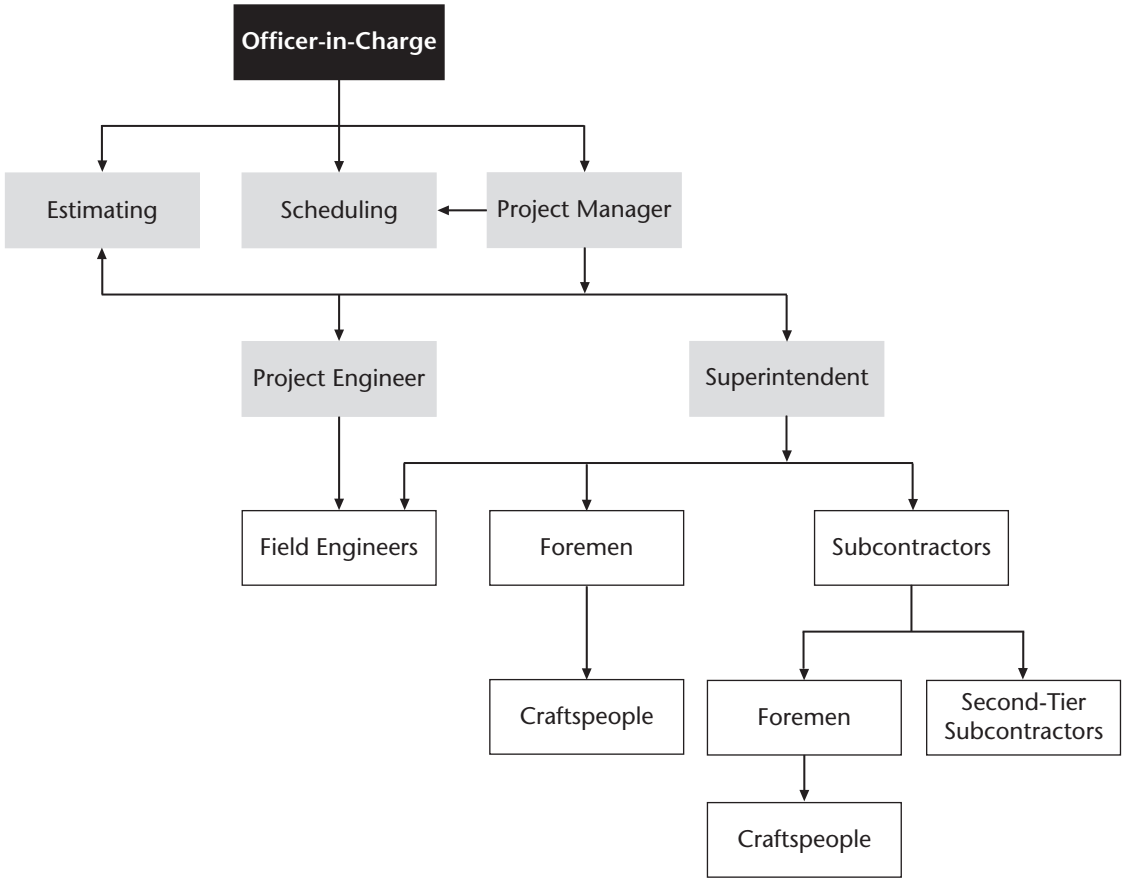


FIGURE 2–4 Contractor's Project Organization

PROJECT MANAGER

The contractor's project manager organizes and manages the contractor's project team. This person's responsibility to upper management is to ensure the project's profitability. The project manager selects and maintains the appropriate team to economically and efficiently complete the project to the owner's standards, as set forth in the plans and specifications, while making a profit for the construction company. The project manager is responsible for implementing time and schedule control, cost control, and quality control during the project and conducts business with the owner's representative and the architect's project manager. In most contractor organizations, the project manager operates at a higher level than does the superintendent; however, the latter has a great deal of autonomy in managing the project's physical construction. In some organizations, the superintendent is considered an equal to the project

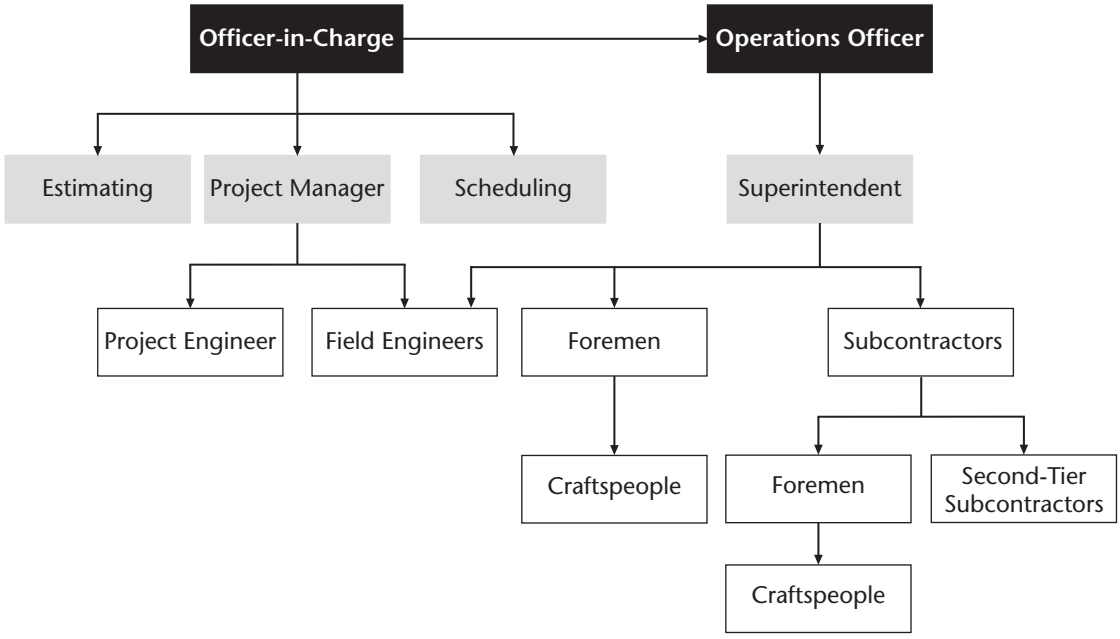


FIGURE 2–5 Contractor's Project Organization, Project Manager, and Superintendent Parallel

manager. Normally, the project manager is more involved in the business and formal requirements of the contract, while the superintendent usually is associated with the activities regarding the construction of the facility. While the organizational chart in Figure 2–4 represents the lines of command where the superintendent reports to the project manager, Figure 2–5 illustrates the contractor's project organization where the superintendent and project manager are at equal, or parallel, hierarchy levels. In this case, an operations officer supervises the superintendents.

During the construction phase of the project, specific estimating and scheduling functions need to be accomplished. Estimating functions during the construction phase relate primarily to estimating changes to the contract. The schedule, of course, is a major planning tool of the construction process and provides a standard for measuring success in compliance to the time constraints on the project. Both of these elements fall under the project manager's domain, but for smaller projects, the project manager may actually personally perform each of these functions. Large construction organizations have estimating and scheduling departments that perform these services for the project manager. Sometimes these duties may be assigned to lower-tier management personnel such as the project or field engineer.

SUPERINTENDENT

With either organizational structure presented, the superintendent is responsible for the correct, timely, and profitable construction of the project. The superintendent has the necessary skills and understanding of common construction methods and practices. This person manages a crew of craftspeople employed by the contractor and subcontractors. It is the superintendent's responsibility to coordinate labor, material, equipment, and subcontractors during project installation. The superintendent determines the labor force, equipment on site, and timing of the delivery of materials and subcontractor work and is responsible for the jobsite: its safety, efficiency, and compliance to the parameters required by the construction documents and regulatory codes. The superintendent is considered a full-time representative of the contractor at the jobsite, while the project manager may be assigned to several projects. The superintendent gives direction to the foremen and craftspeople who are employed by the contractor, coordinates subcontractors, and is the point of contact for subcontractor foremen. The superintendent normally communicates with the architect's contract administrator. If there is an on-site inspector, for either the owner or the architect, the inspector's point of contact will be the superintendent. Depending upon the management philosophy of the contractor, field management employees, such as the field engineer, may report to the superintendent or project manager. The superintendent is often the only member of the contractor's management personnel on the jobsite on small to medium-sized projects. On some small projects, the superintendent actually participates in work activities. In these instances, this person is called a "working superintendent."

PROJECT ENGINEER

The project engineer usually reports directly to the project manager. This person performs paperwork activities for the project manager such as subcontract agreements, material submittals and shop drawings, payment requests, contract change orders, requests for information, correspondence with subcontractors and suppliers, and project documentation. The project engineer normally assists the project manager with any activities that are necessary to keep the project flowing and on track. This person will informally communicate with the architect's project manager, contract administrator, and inspector; however, formal conversations with these individuals usually are pursued by the project manager or superintendent.

FIELD ENGINEER

The field engineer reports to either the project manager/project engineer or the superintendent. The field engineer is involved in the layout of work and the interpretation of the construction documents. This person should be knowledgeable about the contents of the construction documents and is often responsible for documenting jobsite conditions and conversations. The field engineer is responsible for issuing requests for information to the architect about clarifications, differing field conditions, and erroneous information contained in the construction documents.

The field engineer may order materials and review and/or process shop drawings and submittals and is often responsible for quality control and assurance in the project. This position is the lowest tier on the management side of the contractor's employees, but the field engineer is responsible for a wide variety of tasks in assisting the superintendent and project engineer. Some firms will divide the responsibilities of the field engineer, such as assignment of the layout and field coordination, to them. Office work, such as submittals, payments, and change orders, is assigned to the office engineer. In other firms, the assistant superintendent performs most of the tasks described for the field engineer.

FOREMEN

Foremen are supervisory personnel. They usually are paid hourly and receive slightly higher pay than craftspeople. Foremen are responsible for directing the labor crew in their work activities. Foremen, as hourly employees, are not considered management but, rather, labor. Foremen are usually knowledgeable about the installation techniques that are necessary to perform the work of the crew. Foremen create work assignments for craftspeople. They are normally in charge of a crew made up predominantly of their craftspeople, such as carpenters; however, a crew can include several different craftspeople, such as carpenters, laborers, operating engineers, and cement masons. Foremen are responsible for preparing time and quantity in-place reports for cost and schedule control purposes. They also are responsible for reporting work-ready or complete-for-quality inspections. Foremen are responsible for successfully completing work activities within a specific budget and time frame. Depending upon the size of the crew and the nature of the task, foremen may act in a purely supervisory role, or they may actually perform some of the labor for the task, in which case they may be referred to as working foremen.

On large construction projects, a lead craftsperson is used to supervise each crew when the foreman is in charge of several crews. The lead craftsperson normally performs work activities with the crew.

CRAFTSPEOPLE

Craftspeople are hourly employees who are trained to perform specific tasks. Each craft or trade performs its work assignment with a high level of efficiency and quality. The following is a list of some common craftspeople who could be directly employed by the contractor:

Laborer

Carpenter

Operating engineer

Teamster

Ironworker

Cement mason

Construction trades or crafts distinguish between classifications of work performed, resulting in a slight wage differential. The trained craftsperson, receiving the full wage under the work classification, is referred to as a ***journeyman***. ***Apprentices*** are journeymen-in-training and receive a lower wage than journeymen. Some crafts use a ***helper***, who aids the journeyman and is similar to a laborer but lacks the training progression and wage increase of the apprentice. Current trends show that the general contractor is employing fewer and fewer craftspeople, relying now on much of the construction labor to be furnished by subcontractors.

SUBCONTRACTORS

Subcontractors are separate business entities from the contractor. They provide labor, material, equipment, and occasionally second-tier subcontracts to complete a specific portion of the construction. They have agreements with and are responsible to the contractor. All correspondence and requests for clarifications from the subcontractor go to the contractor, who determines which course of action to take. The subcontractor management usually will contact the contractor's project manager or the project engineer for clarifications and contractual discussions. The subcontractor's foreman at the jobsite communicates with the contractor's superintendent concerning work parameters, changes, and directions.

SUBCONTRACTOR FOREMAN

The subcontractor foreman is the subcontractor's site representative. Larger subcontracts will require a superintendent for the subcontractor when there are several crews and a variety of work, for instance, with a large mechanical subcontract. The subcontractor's foreman is responsible for the quality of work accomplished by one's crew or crews. The subcontractor's foreman is often a working foreman in that this person also works with the tools. The subcontractor foreman's primary task is to facilitate a profit for the subcontractor on the particular work assigned for the project and provides direction to one's crew or crews to install and complete the work assigned.

SUBCONTRACTOR CRAFTSPEOPLE

The subcontractor directly employs craftspeople as hourly laborers on the project. Different training and classifications are assigned to craftspeople who are doing specific tasks. Figure 2–6 lists some of the trades that subcontractors utilize on the jobsite. Some subcontractors employ the same craftspeople as the contractor; however, they usually perform different types of tasks.

Other Roles in the Construction Process

Significant roles in the construction process are played by entities other than the owner, architect, and contractor. The majority of these individuals represent regulatory agencies, as required by the municipal, state, or federal governments.

Laborer	Glazier	Lather
Carpenter	Plasterer	Taper
Operating Engineer	Ceramic Tile Installer	Floor Covering Installer
Teamster	Terrazzo Mechanic	Painter
Ironworker	Elevator Mechanic	Millwright
Cement Mason	Plumber	Pipe Fitter
Bricklayer	Steamfitter	Sprinkler Fitter
Roofer	Mechanical Insulator	Temperature Control Mechanic
Sheet Metal Worker	Refrigeration Mechanic	
	Electrician	

FIGURE 2–6 List of Trades Employed by Subcontractors

There are a number of inspectors from different agencies and levels of government who need access to construction sites. These inspectors examine the installations for compliance to codes that are legislated standards of compliance necessary to protect the public. The codes apply to the design and installation of the particular systems in the project and supersede the contract documents. It is assumed that the contractor has met all of the codes with one's installations. State industrial safety agencies and the federal government industrial safety agency, the Occupational Safety and Health Administration (OSHA), also have the right to inspect the jobsite for safety compliance.

Figure 2–7 lists some of the inspections that are common to building construction.

Inspector	From	Items Inspected
Building Inspector	City, County	Concrete Footings, Concrete Reinforcing, Wood Framing, Steel Framing, Final Compliance
Plumbing Inspector	City, County	Plumbing Rough-in, Sewer Installation, Water Line Installation
Electrical Inspector	City, County, State	Electrical Rough-in, Electrical Finish
Fire Marshal	City, State	Fire Alarm Systems, Fire Protection Systems
Elevator Inspector	City, State	Elevators, Conveyance Systems
Safety Inspector	State, Federal (OSHA)	Safety Compliance of Jobsite

FIGURE 2–7 List of Typical Inspections

Communications in the Traditional System

The previous discussion indicated that there are distinct hierarchical levels within each organization. Communications, whether they are verbal or written, are normally between individuals at the same level. Figure 2–8 illustrates a communications matrix indicating direct, or contractual, lines of communications, and indirect, or nonbinding, communications. This is one possible communications matrix, with other matrices being utilized when other contractual agreements are chosen.

During the construction phase, special care must be taken to avoid communications that transcend the contractual lines of privity. Subcontractors should not communicate directly with the architect but should approach the contractor's superintendent or project manager. Most problems on the jobsite have a larger impact than just the particular subcontractor's work, and the superintendent or project manager has the responsibility and perspective to discern the full impact of the change or concern. There is often informal communication between parties; however, throughout the construction process, considerable communication takes place between the sub-consultants and subcontractors that may be technical in nature and may be misconstrued if transferred through several parties. Informal communication is important for clarifications, but binding clarifications, changes, and directions must go through the proper contractual channel, preferably, and are

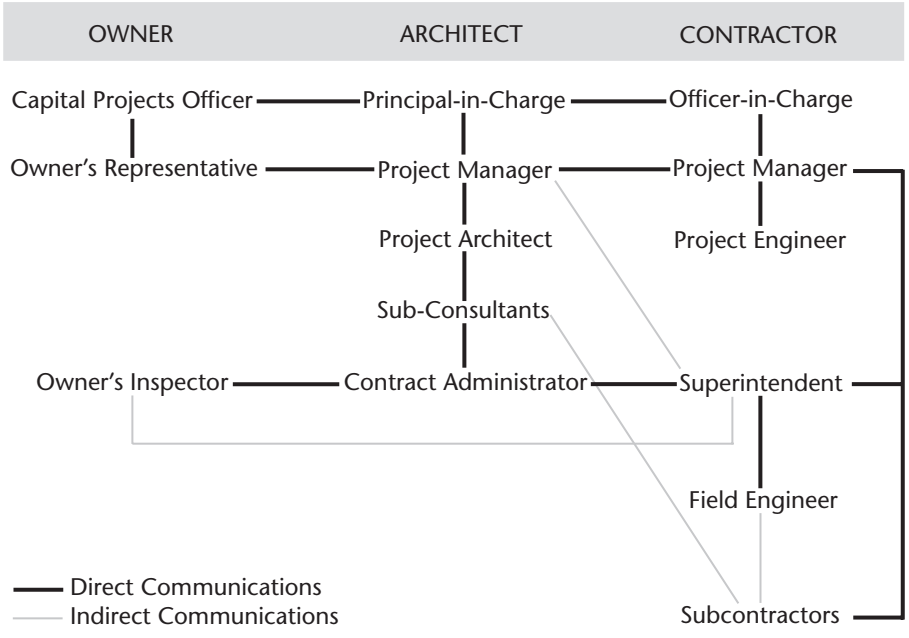


FIGURE 2–8 Communications Matrix, Traditional System

often required in writing. The sub-consultant and subcontractor should be careful to transmit information that has an impact on the contracts to the architect and contractor for official and binding communication.

The Construction Management Delivery System

The traditional delivery system does not always meet all of the owner's needs. On complex projects, where budget, time, and/or quality are exceptional concerns in the project, the construction management (CM) delivery system may be used to accommodate those needs. The CM process applies contractor-based management systems early in the project, providing more tools and controls to contain the project within its scope parameters during the design as well as the construction process.

There are two basic forms of CM:

- Agency CM
- CM-at-Risk, CM/GC, Multiple Prime, or Guaranteed Maximum Price (GMP)-CM

Agency CM involves the use of a manager, as the agent of the owner, without design or construction responsibilities. The construction manager in the agency arrangement works on a fee basis with the owner. Agency CM enters the process early and acts only as the agent of the owner throughout the process. The Agency construction manager brings management tools to all phases of the work without having a vested interest in either the design or construction of the building.

Figure 2–9 illustrates the organization of the Agency CM arrangement.

Under the Agency CM system, the contracts for the architects and contractors are written directly with the owner; however, the construction manager acts as the owner's agent and manages both the architect and the contractor. Depending upon the level of service offered by the construction manager, the contractors may be trade contractors, execution contractors, or specialty/subcontractors,

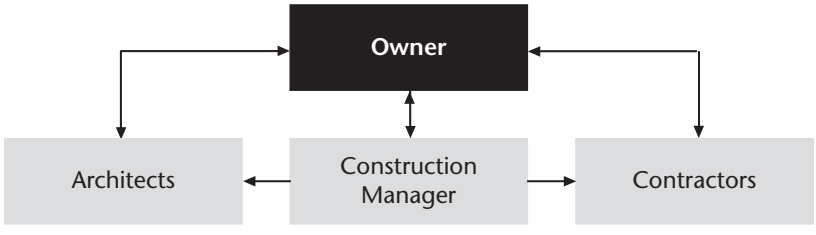


FIGURE 2–9 Organization of the CM Delivery System (Agency CM)

without a general contractor, and may be managed by the construction manager. This type of system is usually referred to as "Multiple Primes," where there are multiple contracts directly to the owner, managed by the construction manager. Under this system, the architect's position in the construction phase of the project is reduced to an advisory role, with the construction manager providing the construction administration for the owner. Figure 2–10 illustrates a typical Multi-Prime contracting arrangement.

Although the CM system adds another layer of bureaucracy to the project, it provides a more intense and appropriately focused management of the process than does the traditional process. It is best utilized by an owner who has little or no construction expertise within one's organization, relying on the CM firm to coordinate the project. One prominent CM firm advertises its services as "Extension of Staff." The CM process provides the owner with specialized management to control problems with project duration, project budget and cost, or project quality. Although the fee for the CM firm appears to be an additional cost to the owner, the construction manager is replacing the owner's in-house construction manager, also a significant project cost. CM Agency could be utilized with virtually any project delivery system.

CM-at-Risk is similar to the GMP arrangement in the traditional system, except that the construction manager is involved in the conception and design of the project rather than entering after the completion of the contract documents. The construction manager in this arrangement provides the owner with a maximum price for the project, considering the project's initial scope. The GMP construction manager manages the construction phase much like a contractor does under the traditional system, often subcontracting out all or most of the work. The roles during the construction phase under the CM system are modified from the traditional system.

The roles involved during the construction phase for the CM system include the following:

- The owner, who still provides funding for the construction and the site for the project. The owner makes the decisions about the project but is advised in all matters by the construction manager. As the construction manager handles the entire project, from conception through completion, the owner has little day-to-day involvement.
- The construction manager, who is responsible for the administration of the construction contracts during the construction phase of the project. The construction manager maintains a liaison with the architect for advice on intent of the documents. This person schedules and manages the submittal process, while the architect reviews the submittals and shop drawings. The construction manager may provide a detailed schedule for the completion of the construction and acts as the communications conduit for the contractor or contractors on the project. The construction manager also will process progress payments and contract completion.

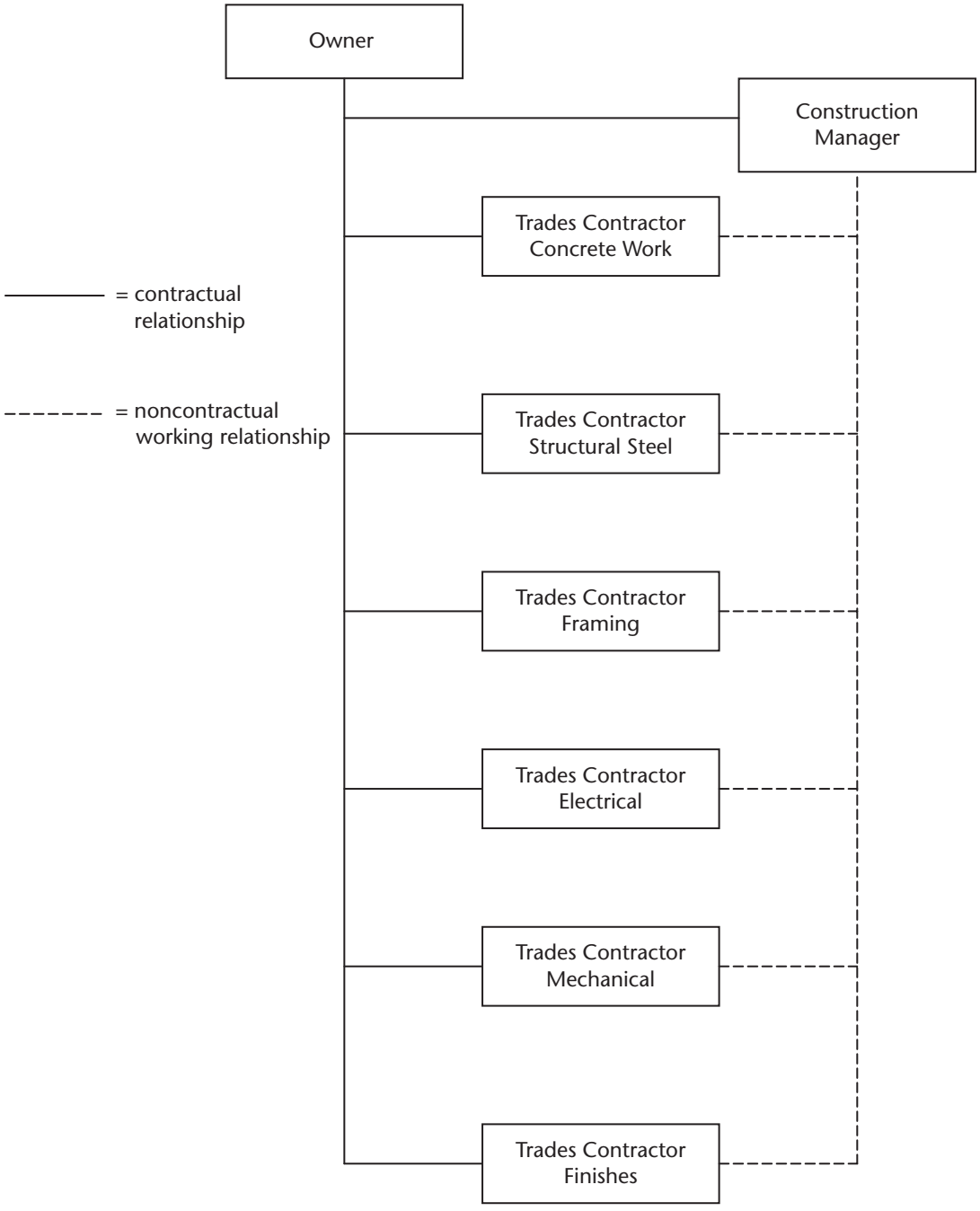


FIGURE 2–10 Typical Multi-Prime Contracting Arrangement

- The architect, who is engaged to design the project and prepare construction documents. During the construction phase, the architect serves as a reference and an adviser on the intent of the construction documents, but the construction manager is responsible for the administration of the project. The architect is involved in reviewing submittals and shop drawings but under this system is not normally involved on a daily basis in the construction of the project.
- The contractors, who, under the CM process, play a role similar to that of the subcontractor in the traditional system. The contractor may be assigned a large element of the work, such as the foundation or building envelope, or may be awarded a small contract, such as caulking and sealants. The smaller subcontracts, which encompass work by a single trade, are usually called ***trade contracts***. For larger portions of work, the contractor would employ a superintendent but would still look to the construction manager's superintendent for coordination of the work.

Roles of the CM Project Team

Figure 2–11 illustrates the roles of personnel within the CM project team. Each project and CM firm will use a variation of this basic arrangement.

The roles involved in the CM team include the following:

- The project manager, who is the party responsible to the owner for the success of the project. The project manager is in charge of all of the CM employees on the project. This person primarily oversees the construction process;

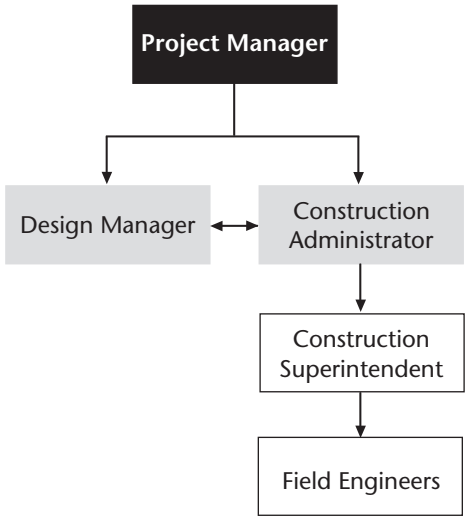


FIGURE 2–11 Construction Management Roles

however, most of the contact with the contractor during the construction phase is handled by the construction administrator.

- The design manager, who is involved with the architect during the design and construction processes. The decisions concerning contract packaging, early purchase of materials, and project strategies are made during the design phase of the project. Some CM firms have the design manager act as the construction administrator, while other firms will use different individuals who possess specific skills for their phase of the project. Liaison and communication need to continue between the design manager and the construction administrator concerning the intent of the design.
- The construction administrator, often referred to as the construction manager, who is in charge of the construction process for the CM firm. The construction administrator is the contact person for the contractors' project managers and is responsible for the entire construction process, delegating part of the field responsibilities to the construction superintendent and the field engineers.
- The construction superintendent, who coordinates the field activities. Unlike the traditional delivery system where the construction superintendent is in charge of direct labor and subcontractors, in the CM delivery system this person manages only the trade or execution contractors, as the construction manager does not use direct labor. In cases where the contractor or contractors do substantial portions of the work, such as when using Multiple Primes, providing coordination of the subcontracts within their scope, the construction manager may utilize a construction administrator and not a construction superintendent. It is essential, however, to have a knowledgeable construction superintendent on the site when using myriad trade contractors in order to provide some order to the process. The construction superintendent is responsible for maintaining the construction schedule, for ensuring compliance of all work to the documents, and for coordinating all of the trade contractors. The construction superintendent may need assistance from the field engineers, depending upon the scope of the project.
- The field engineer, who is responsible for the coordination of shop drawings, submittals, layout, subcontractor organization, payment verification, and whatever duties are assigned by the construction superintendent or construction administrator.

Communications in the CM Delivery System

The matrix of communications lines in a typical Agency CM project for the construction phase is illustrated in Figure 2–12.

Since the construction manager is the controlling entity in the project, all communications flow through this person. This system should facilitate prompt responses to communications throughout the construction phase.