SECTION I

SETTING THE STAGE

CHAPTER 1

OVERVIEW OF THE CONSTRUCTION INDUSTRY

INTRODUCTION

The construction supervisor functions in a business environment that is fraught with challenges and filled with opportunities. In this environment, the work is demanding, both physically and mentally. The environment is permeated by risk and uncertainty. There is endless variability in the type of work to be done on construction projects and among the people who manage and perform the work, and among the contract systems and project delivery methods being employed. Seemingly, the industry grows more complex and more demanding every day.

Yet the construction industry can also be tremendously rewarding. For those who learn how to manage the elements of challenge presented by the industry, the benefits are both numerous and long-lasting. Financially, construction can be very rewarding to those who are successful in the practice. The numerous variables that present risk and uncertainty also render the work endlessly challenging and interesting. And certainly, few other professions offer the very tangible fulfillment and sense of accomplishment that the construction industry provides. Almost without exception, those who have had a hand in the building of a construction project are able to view the completed project and, with a sense of enormous pride and satisfaction, to say, "I built that."

This book will begin by making note of some characteristics and truisms pertaining to the construction industry. It will also be noted that, for the construction supervisor, the construction industry is filled with enormous opportunity, especially for those who are willing to learn how to manage within the industry, and who are willing to continue their learning so as to meet the continuing challenges and complexities of an evolving industry.

CONSTRUCTION VOLUME AND IMPACT ON SOCIETY

The construction industry has long been, and certainly continues to be, a major force in the economy of the United States. By any standard of measure—fraction of U.S. Gross Domestic Product comprising construction, amount of direct and indirect employment of the U.S. workforce comprising the construction industry, number of workers employed in the industry, or percentage of the total U.S. workforce employed in the industry—the construction industry is a huge component of business in the United States. Additionally, construction is increasingly becoming a globally integrated industry, as more and more U.S. construction firms work internationally, and as more and more firms from around the globe perform work in the United States.

In addition to being very large, the construction industry is also very diverse. Work is performed in many different industry segments, including commercial, institutional, and residential buildings. These buildings are typically designed under the leadership of architects and are frequently referred to as "architectural construction."

Additionally, the industry includes what is referred to as "engineered construction facilities." Examples include industrial facilities, such as refineries, processing plants, fresh water and wastewater treatment plants, and manufacturing facilities, as well as utilities, pipelines, transmission lines, roadways, airports, bridges, dams, and so forth. These types of facilities are typically designed by engineers; hence the term "engineered construction projects."

A great deal of construction work is characterized as new construction—the construction of a new facility on a vacant site. Additionally, a large segment of construction work consists of remodeling, restoration, renovation, and adaptive reuse of existing facilities.

Construction work is performed by companies, which may be large or small, in terms of volume of work performed and number of people employed. Some of these firms, known as specialty contractors, specialize in a particular market segment, while others, known as general contractors, choose to encompass a broad scope of types of work performed.

Construction work is performed by a number of different project delivery methods, including design-bid-build, also known as linear construction; design-build; design-procure-construct (DPC); phased construction, also known as fast track; job order contracting; and others. Additionally, a number of different types of

contractual arrangements are employed in the performance of the work, including single contract contracting; multiple prime contracts, also known as separate contracts contracting; construction management agency and construction management at-risk; and others. Construction contracts may be defined as public or private, and may take the forms of lump sum, also known as hard money, unit price, cost reimbursable, and others. In addition, construction contracts are awarded by a number of different methods, including competitive bid, negotiated, competitive sealed proposals, and others.

For the construction supervisor, this tremendous volume and diversity in the construction industry, equates to opportunity. The business community, and society in general, place a huge reliance upon the construction industry. This means that, for the person skilled in the performance and management of construction work, opportunity abounds. One of the primary purposes of this book is to add to the knowledge base of those who supervise construction projects, so as to enhance their opportunities for continuing success in the construction industry, as well as to enhance the chances for a successful project for the owner.

PROFIT, PROFITABILITY, AND THE SUPERVISOR'S IMPACT

In a free enterprise economy, the basic reason for a construction firm to be in business is to earn a profit from its performance of construction contracts. This fundamental premise is central to the operation and continuance of the business enterprise.

Therefore, the construction work that a company undertakes must be performed in compliance with the requirements of the contract documents for each project, and also must be performed at a cost equal to or less than the contracted cost of completing the work. This implies, in turn, that the work must be performed and managed with cost consciousness and budget consciousness in mind, and in such a way that the company will earn a profit from the performance of the work.

The construction supervisor plays a huge role in determining the profitability of the construction work that a construction firm performs. As the management person closest to the workface, that is, to where the work is actually performed by skilled construction craft workers, the supervisor continually makes decisions and takes actions that directly affect the cost of the work, as well as the duration of the project and the quality and the safety of the work.

While many others in the construction firm also have a role in ensuring the profitability of construction projects, it is the supervisor who plays a central role. Therefore, it is incumbent upon the supervisor to be knowledgeable of the environment in which the work is performed, of the work itself, and of the best way to perform the work, and also to have the knowledge to perform the work in such a way as to fulfill all of the objectives for each project, including profitability.

COMPETITION, RISK, AND CONSTRUCTION COMPANY FAILURE

In addition to the other truisms regarding the construction industry that have been noted, certainly there are three additional important aspects of the construction industry that are also worthy of note. First, the construction industry has been for many years, and certainly continues to be, one on the most highly competitive of all industries. Second, risk permeates the industry in general and construction operations in particular. Third, the failure rate for construction companies is among the highest of any business.

Competition is at the heart of most contract awards in the construction industry. For many years in recent U.S. history, owners (who decide what the contract award system will be for a construction project) have employed lump-sum competitive bidding or unit-price competitive bidding as the primary method for awarding contracts to prime contractors. In these contract award systems, a series of documents, called the contract documents for the project, describes in detail the work to be done and sets forth the owner's requirements in the work. With this complete set of contract documents in place, contractors who are interested in the project will prepare proposals, or bids, wherein they set forth their proposed prices on a lump sum or unit price basis. These are the prices for which they would be willing, if selected by the owner, to enter into a contract to fulfill all of the requirements of the contract documents in constructing the project for the owner.

Contractors' proposals are submitted to the owner on a specified date and time, and in a designated location. Typically, the contractor who submits the lowest bid, or the lowest valid bid, is selected by the owner to be the contract recipient. So contractors are in competition with one another for the contract award, based on the lowest price for which they are willing to enter a contract to fulfill the contract requirements as established by the owner.

The rationale on the part of the owners in their use of this contracting method is that if the contract documents completely describe all aspects of the work to be performed, and if all of the bidding contractors prepare their proposal prices based on this same information, then the owner will receive the benefit of all of the contractors competing with one another for the contract award. The owners can then make a decision based on the price submitted by each contractor. Thus, the owner will know what he or she will receive, that is, what the contract deliverables will be, as described in the contract documents. Additionally, the owner should be able to have the work performed at the best possible price, based on the competition by contractors for the contract award.

While other methods of contract award are frequently employed today, competitive bidding is still very commonplace. Even when methods of contract award other than competitive bidding are utilized by owners today, competition among contractors for the award of the contract from the owner remains central to the project delivery method of choice. The competition may be based on many different criteria, such as contractors' record of successful projects completed in the past, the quality of work performed, quality assurance programs,

safety records, qualifications and credentials of the contractors' personnel, and so forth.

Competition among contractors for the contract from the owner remains at the heart of owners' seeking to obtain maximum value for their construction contract expenditures. Additionally, in the same fashion in which owners place contractors into competition for the award of the prime contract (the contract between the owner and the prime contractor), prime contractors typically employ a competitive methodology with subcontractors for the award of the subcontracts to the specialty contractors who will be selected to perform work on the project.

From the foregoing, it can be clearly seen that competition among contractors is, historically and today, very deeply embedded in the culture of construction contracting. Every indication is that this fact will remain a constant in the industry. Construction contractors continually are in quest of some means of achieving a competitive advantage, so as to maximize their prospects for the award of construction contracts.

Like competition, risk is an element that is constantly present in the construction industry. The risks that a construction contractor must overcome, in a company and on a project, are both numerous and significant. A great deal of the work on a construction project is inherently hazardous in many of its aspects. Construction sites, and the environment in which the work on a construction project is performed, vary greatly with regard to numerous factors, which translate into risk for the construction contractor. Heavy and cumbersome materials and equipment must be installed under a variety of conditions, and often at considerable heights or depths, or in confined spaces. Many of the materials and systems to be installed in a construction project are themselves inherently dangerous. The productivity of the skilled construction labor force is subject to many variables, and thus production rates become undependable and difficult to predict. Many construction operations are sensitive to weather, and the variability and unpredictability of the weather can wreak great havoc on a construction project. The dependability of suppliers, subcontractors, and the skilled construction craft labor force, varies widely. Much of the work involves the use of machinery and equipment, and its use introduces other elements of risk into the process. Many construction components, and systems and subsystems, must be installed with great precision—even the smallest error, or the smallest deviation from a standard, can render a system inoperative or dangerous. Many construction projects consist of a very large quantity of materials and products, each of which must be procured, managed, and properly installed; their sheer number provides a management challenge and introduces risk into the construction process. The dollar amounts—in the construction contract amount, subcontract amounts, materials, equipment, and labor prices—are huge. By their very nature, the financial commitments on a construction project are a source of risk. Contract award methods that place contractors and subcontractors into competition for the award of construction contracts introduce risk. Successful contractors and successful construction supervisors are those who come to terms with the risk inherent in the business, and who learn methods to recognize, mitigate, and deal effectively with the numerous risks that the work in the industry entails.

In an environment of intense competition and enormous risk, many construction companies do not survive. In fact, for prime contractors and subcontractors alike, the failure rate of construction businesses is among the highest of any business classification. Those companies that endure and are successful are those that recognize and successfully come to terms with the competition, the uncertainty, and the risk that are inherent in the construction business. Supervisors who can recognize these facts, and who can learn to manage in this uncompromising environment, are those who are much more likely to succeed in the future.

DEFINITIONS AND ROLES OF CONSTRUCTION TEAM MEMBERS

A number of different people compose the team that is typically formed for the construction of a project. It is important for the supervisor to recognize the names, typical functions of, and typical relationships between these people. These are set forth in the paragraphs that follow, and are graphically depicted in Figure 1.1.

While there may be some amount of variance in who these people are, and in the roles they play on the construction team, according to the type of project and by the project delivery method being employed, these parties and their functions and relationships are typical of those that are utilized on a building construction project, with a single contract system in use, and with a lump-sum competitive bid contract award method in use.

Owner

The owner initiates the entire design and construction process, and all of the events that follow, when he or she perceives a need for a new facility, for additional space, or for renovated space.

The owner analyzes finances, determines budget, determines equity and borrowed capital necessary. The owner seeks the services of a professional designer, architect or engineer, to produce a design and to lead the design process. He or she enters a contract with the architect or engineer of choice.

The owner's basic expectations of designer are that he or she will:

- Produce a design that will satisfy the needs of the owner, within the constraints of the owner's budget
- Assist the owner in forming a contract with the construction contractor
- Oversee the construction of the project by the construction contractor, to protect the owner's interests
- Assist the owner during the contract warranty period

The owner enters into a contract with the contractor, as well as with the designer, and throughout the project coordinates the work of the contractor and designer, funds the project as it proceeds, works with the design team to resolve problems, and accepts the project when it has been completed.

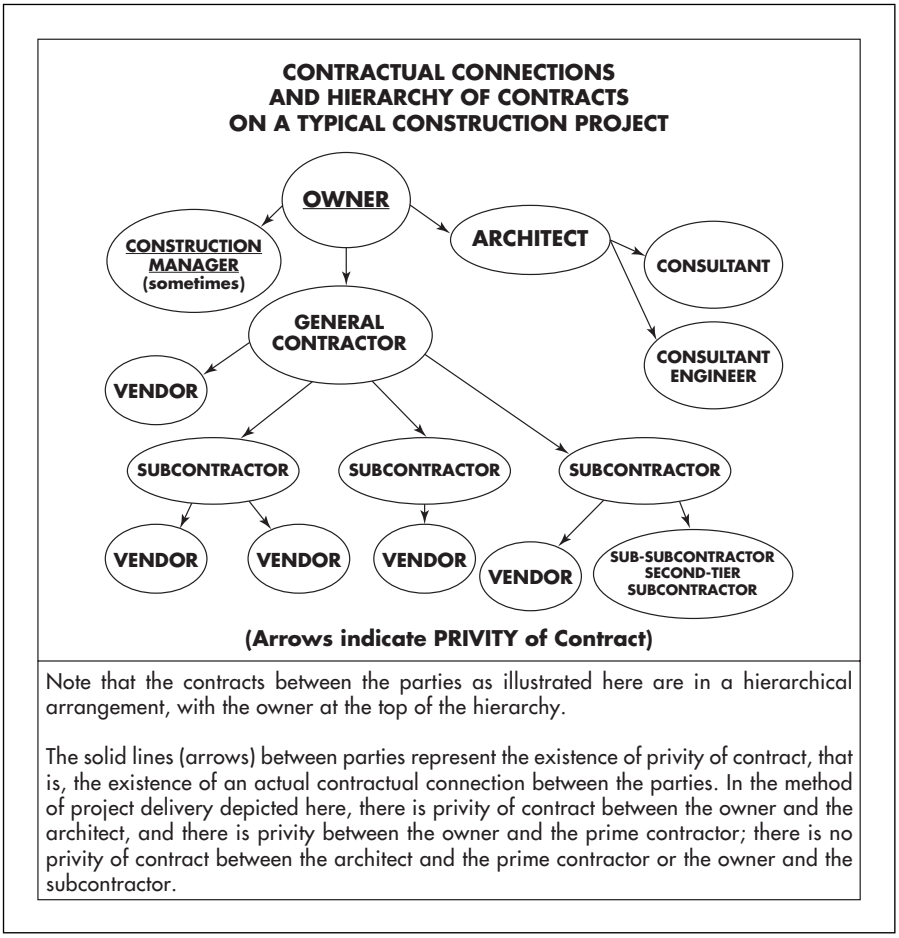

Figure 1.1 Contractual Connections and Hierarchy of Contracts on a Typical Building Construction Project

Architect or Engineer

Architect—for building construction projects.

Engineer—for industrial facilities, fresh water and wastewater treatment plants, and manufacturing facilities, as well as pipelines, transmission lines, utilities, roadways, airports, bridges, dams, and so on.

The architect or engineer is referred to as the primary designer, or as the designer of record.

The architect or engineer enters a contract with the owner to provide the following basic services:

- Assist the owner in development of owner's program of requirements
- Produce a design which will satisfy the needs of the owner, which can be built for the amount of money in the owner's budget

- Produce drawings, specifications, and other contract and bid documents for the project, including the contract that the owner and the contractor will execute
- Assist the owner with making contractors aware of the existence of the project, and facilitate contractors' obtaining of contract and bid documents
- Facilitate contractors' proposal preparation and submittal
- Conduct the bid opening
- Counsel and assist the owner with regard to selection of, and final contract formation with, the contractor
- Observe the construction during its progress, to provide reasonable assurance to the owner that the construction contractor is fulfilling contract requirements
- Administer change orders during the course of construction
- Approve prime contractor's payment requests and authorize the owner to make payment to the contractor
- Administer the punchlist process, as well as the project closeout process, issue the Certificate of Substantial Completion, and administer the contractor's Request for Final Payment
- Assist the owner during the warranty period

Consulting Engineer

The consulting engineer is an engineer who has professional expertise in a system or component to be included into the design by the primary designer, whether the primary designer is an architect or an engineer. The consulting engineer is usually retained and paid by the primary designer. Typical examples include civil engineer, structural engineer, and mechanical engineer, among others.

Consultant

The consultant is a person who may not be an engineer or an architect, but who is an expert with regard to a product or system that is to be incorporated into the project. The consultant is utilized by the primary designer, architect, or engineer, to provide assistance with some aspect of the design. Usually, this person or firm is retained by the primary designer and is paid directly by the primary designer for his or her services on a consulting basis.

Construction Manager

A construction manager is sometimes utilized on construction projects and sometimes not, at the election of the owner. Construction managers function

in different capacities, and their responsibilities vary considerably, depending upon the terms of their contract with the owner.

A general definition, which will serve us well in the context of considering team members on a construction project, is: the construction manager is one who enters a contract with the owner, and by the terms of that contract, represents the interests of the owner in his contracts with the architect (or engineer), and with the prime contractor.

Construction managers may function in an "agency" capacity, wherein they are legally bound to act in the best interests of the owner, and they provide consulting, counsel, and assistance to the owner; the owner then acts upon that counsel or not, at his discretion.

Additionally, construction managers may function in an "at risk" capacity, wherein their contract with the owner no longer recognizes them as an agent of the owner, but makes them financially responsible for delivering the project to the owner within specified limits of time and money. This form of construction management contract is often referred to as CMAR, construction manager at risk.

Prime Contractor

The prime contractor enters into a contract with the owner to fulfill all of the requirements set forth in the contract documents. The prime contractor usually provides all materials, labor, equipment, support staff, and other resources that are necessary to do so.

A person is defined as a prime contractor inasmuch as he or she enters into a contract with the owner. Usually contractors who function in this capacity refer to themselves as general contractors, building contractors, and similar titles.

Subcontractor

A subcontractor enters into a contract with the prime contractor to perform a defined segment of the work on a project. Traditional subcontractor or specialty contractor trades include: plumbing; electrical; heating, ventilating, and air conditioning; masonry; roofing; drywall; tile setting; glazing; and the like. Today, subcontractor specialists are available to perform almost any task or scope of work on a construction project.

Sub-Subcontractor

The sub-subcontractor enters into a contract with a subcontractor to perform some specified aspect of the work for a project for the subcontractor. This person is also referred to as a second-tier subcontractor.

Vendor or Materials Supplier

The vendor or materials supplier enters into a contract with the prime contractor or with a subcontractor, to provide a material or products specified for the project. This person provides no labor for installation. The contract

for materials purchase is often referred to as a purchase order, or purchase agreement, or purchase order agreement.

BECOMING AN EFFECTIVE SUPERVISOR

It is within this complex and demanding domain, where many different people have important roles to play, where numerous different contracting methods are employed, and where risk, variability, and uncertainty are constant companions, that the construction supervisor functions. Supervising and managing effectively in this environment can be a daunting task. As has been noted, however, it is also a most fulfilling and rewarding opportunity.

Those who can meet the challenges, who can master the complexities, who can be effective managers and decision makers, and who can consistently fulfill project objectives are those who have assured themselves a bright and rewarding future in management in the construction industry. Providing guidance and assistance to the person who aspires to these goals is one of the primary objectives of this book.

SUMMARY

Key points of learning in this chapter include the following:

- The construction industry is huge, and diverse, and has a tremendous impact upon the economies of the United States and other companies around the world;
- Opportunities for success and satisfaction abound for those who are successful in construction;
- Construction companies are in business to earn a profit, and those who supervise construction work have an enormous impact on the profitability of construction work;
- Competition is intense and risk is high in the construction industry; but there are tremendous rewards for those who can manage in such a way as to be successful;
- Construction is performed by a number of different contracting and contract award methods;
- There are a variety of people who comprise the construction team on projects: owner, architect, engineer, consultant, construction manager, prime contractor, subcontractor, sub-subcontractor, materials suppliers;
- Effective supervisors, those who can consistently fulfill project objectives in the complex and demanding environment of the construction industry, have a bright and rewarding future in the industry.

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Learning Activities

Obtain a copy of Engineering News-Record magazine, and the issue containing the "ENR Top 400 Contractors" feature, published every year in May.

Additionally, you may wish to read the "Top 600 Specialty Contractors" feature, published in the magazine every year in October.

The ENR magazine may be subscribed to by someone in your company, or you can obtain a copy from your local library.

You can also view these feature articles of the magazine online at: http://enr.construction.com/toplists/

These features, and the other information in the magazine as well, will help you not only to see who the largest firms are, but also will enable you to see the tremendous impact the construction industry has on all aspects of the U.S. and worldwide economy.

You can broaden and enhance your own learning with this information. In addition, you may wish to share some of this information with others in your company in your "toolbox talks."