Chapter 1

The Construction Industry

1.1 INTRODUCTION

The construction industry is very large by any standard, and it can be described and defined in a number of different ways. This chapter will begin to characterize the industry in terms of its size and economic impact, and will proceed to define by name and by function some of the practitioners who perform their professional work in the industry. Also to be examined are terminology relative to types of contracts, public and private; single and separate contracts; competitive bid and negotiated contract formation; different project delivery methods; different types of construction contractors; and various types or categories of construction projects. All of these are vantage points from which the construction industry can be observed, and all of these terms provide descriptors for various aspects of the professional practice of construction contracting in the industry.

1.2 THE CONSTRUCTION PROJECT

Humans are compulsive builders who have demonstrated throughout the ages a remarkable and continually improving talent for construction. As knowledge and experience have increased, the ability of humankind to build structures of increasing size and complexity has expanded enormously. In the modern world, everyday life is maintained and enhanced by an impressive array of construction of all kinds, awesome in its diversity of form and function. Buildings, highways, tunnels, pipelines, dams, docks, canals, bridges, airports, and a myriad of other structures are designed and constructed so as to provide us with the goods and services we require. As long as there are people on earth, structures will be built to serve them.

Construction projects are complex and time-consuming undertakings. The structure to be built must be designed in accordance with applicable codes and standards, culminating in working drawings and specifications that describe the work in sufficient detail for its accomplishment in the field. The building of a structure of even modest proportions involves many skills, numerous materials, and literally hundreds of different operations. The assembly process must follow a certain order of events that constitutes a complicated pattern of individual time requirements and sequential relationships among the various segments of the structure.

Each construction project is unique in its own way, and no two are ever quite alike. Each structure is tailored to suit its environment, designed and built to satisfy the needs of its owner, arranged to perform its own particular function, and designed to reflect personal tastes and preferences. The vagaries of construction sites and the infinite possibilities for creative and utilitarian variation of the structure, even when the building product seems to be standardized, combine to make each construction project a new and unique experience. The designer produces a design for each project to meet the needs of

the owner within the constraints of the owner's budget. The contractor sets up a production operation on the construction site and, to a large extent, custom-builds each project.

The construction process is subject to the influence of numerous highly variable and often unpredictable factors. The construction team, which includes various combinations of contractors, owners, architects, engineers, consultants, subcontractors, vendors, craft and management workers, sureties, lending agencies, governmental bodies, insurance companies, and others, changes from one project to the next. All of the complexities inherent in different construction sites, such as subsoil conditions, surface topography, weather, transportation, material supply, utilities and services, local subcontractors, and local labor conditions, are an innate part of the construction project.

As a consequence of the circumstances noted above, construction projects are typified by their complexity and diversity, and by the nonstandardized nature of their design and construction. Despite the use of prefabricated units in certain applications, it seems unlikely that field construction can ever completely adapt itself to the standardized methods and the product uniformity of assembly-line production.

1.3 ECONOMIC IMPORTANCE

For a number of years, construction has been the largest single production industry in the American economy. It is not surprising, therefore, that the construction industry has a great influence on the state of this nation's economic health. In fact, construction is commonly regarded as the country's bellwether industry. Times of prosperity are accompanied by a high national level of construction expenditure. During periods of recession, construction is depressed, and the building of publicly financed projects is often one of the first governmental actions taken to stimulate the general economy. When the construction industry is prospering, new jobs are created, both in direct employment in construction, as well as in related industries, such as materials and equipment manufacturing and supply. A high level of construction activity and periods of national prosperity are simultaneous phenomena; each is a natural result of the other.

Some facts and figures pertaining to construction in the United States are useful in gaining insight into the tremendous dimensions of this vital industry. The total annual volume of new construction in this country at the present time is approximately $1.75 trillion. The annual expenditure for construction normally accounts for about 10 percent of the dollar value of our gross domestic product. Approximately 80 percent of construction is privately financed, and 20 percent is paid for by various public agencies. The U.S. Department of Labor presently indicates that construction contractors directly employ more than 7 million workers during a typical year. If the production, transportation, and distribution of construction materials and equipment are taken into account, construction creates, directly or indirectly, about 12 percent of the total gainful employment in the United States.

1.4 THE PEOPLE INVOLVED ON A CONSTRUCTION PROJECT

Construction projects are designed and built through the combined efforts of a number of people. Each has a defined role and a set of accompanying responsibilities in the total effort. These roles, as well as the rights and responsibilities of those who participate in the process, are defined in contracts that are formed between the various participants.

While the construction industry is often described in terms of materials, such as concrete, steel, masonry, and many others, or in terms of project delivery systems and contracting methods, it can also be typified in terms of the people who interact in the process which results in a completed project.

It is the people who are involvd in the design and construction of a project who bring the project to fruition. Construction contracting can therefore best be characterized as a people-oriented business and profession.

1.4.1 Owner

The owner is the central figure in any construction project. The owner can be defined most directly as the person who will own—literally will have title to—the project upon its completion. The owner is also the person who will pay for the design and construction of the project.

It is the owner who initiates all that will follow in the design and construction processes. The inception of any construction project begins with the owner's recognition of a need for a constructed project, whether it be a new building or an expanded or renovated building or a facility such as a highway, industrial plant, or airport. Most owners perceive this need and refine its ramifications over a period of time, until at some point the decision is made to move forward with the idea.

Typically, the owner will next think in terms of financing—how much money he is willing or able to commit to satisfy this need. Additionally, the source of these funds is considered and analyzed. Determinations are made regarding whether the forthcoming project will be funded with owner's funds or with borrowed capital. Most owners will make at least a preliminary determination during the course of this process, with regard to the maximum number of dollars the owner is willing or able to spend for the design and construction that will satisfy the need that has been perceived. This value will become the owner's budget for the project.

Most owners will next seek the services of a design professional—an architect or engineer. The owner will look to this person to assist with defining and codifying, in detail, what the owner's needs are. Then the owner will expect the designer to produce a design that will satisfy the needs of the owner, within the constraint of the owner's budget.

Various methods are employed by owners to determine who the designer will be. The owner may have a familiarity, or a history of past performance, with a certain designer or design firm. Alternately, the owner may seek input from peers and acquaintances regarding competent design firms. Sometimes, the owner may stage a design competition, whereby he sets forth the parameters of his need, and invites design professionals to submit designs in competition with one another for selection by the owner to design the project. These and other methods of the owner's choosing the firm that will produce the design are further discussed later in this book.

It is important to note that the owner will select a design firm and then will enter a contract with that firm. The contract will set forth the exact nature of the services that the designer will provide, and will contain provisions relative to determination and payment of the designer's fees, along with defining all of the administrative elements of the agreement between these parties, as well as the rights and obligations of the two parties. The existence of an actual contract between two parties is referred to as their having privity of contract with each other. The concept of who has privity of contract with whom on a typical construction project is further discussed in succeeding sections of this chapter. Likewise, details regarding the typical content of the contract between the owner and the designer will be further discussed in another chapter. The most common relationship between the owner and the architect-engineer, as well as the names of the other parties most commonly involved in the design and construction of a project, and who has privity of contract with whom, are illustrated in Figure 1.1.

Owners may be characterized as being private owners or public owners, and the construction projects that are designed and constructed for them are described in the same terms. Private owners may be individuals, partnerships, or corporations. The funds that are used to pay for the design and

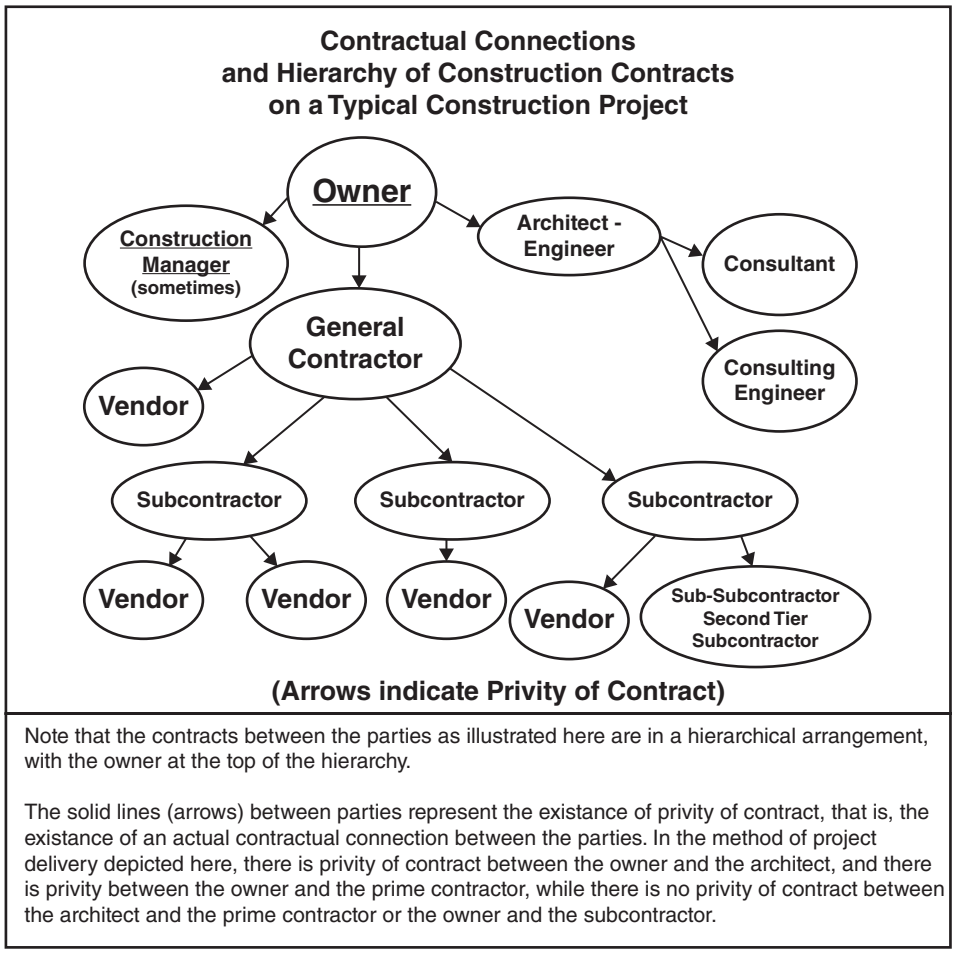

Figure 1.1 People Involved and Hierarchy of Contracts on a Typical Building Construction Project

construction of the project are private funds, that is, not public or government funds. Most private owners have structures built for their own use: business, habitation, pleasure, or otherwise. However, some private owners do not intend to become the end users. Such owners intend that the completed structure is to be sold, leased, or rented to others.

Public owners are defined as some level of government—national, state, county or parish, municipal, or school district—or some agency or department of government. Public owners range from agencies of the federal government down through state, county, and municipal entities, to a multiplicity of local boards, commissions, and authorities. Construction projects that are designed and constructed for public owners are defined as public projects. Such projects are paid for by appropriations, bonds, tax levies, or other forms of public funding, and are designed and built to meet some defined public need. Public owners are required to proceed in accordance with applicable statutes and administrative directives pertaining to all aspects of the design and construction process.

Most owners relegate by contract the design of their projects to professional architecture or engineering design firms, and award contracts for the construction of their facility to construction contractors. However, there are some owners who, for various reasons, elect to play an active role in the design and/or the construction of their projects.

For example, some owners perform their own design, or at least a substantial portion of it. In similar fashion, some owners choose to act as their own construction managers or perhaps even to perform their own construction. Many industrial and public owners have established their own construction organizations that work actively and closely with the design and construction of their projects. These concepts are further discussed in other sections of this chapter.

1.4.2 The Architect-Engineer

The designer or design firm, also known as the design professional, is the party, organization, or firm that designs the project. Both architects and engineers are licensed design professionals. Because the design of facilities is architectural or engineering in nature, and is often a combination of both, the term *architect-engineer* is used in this book to refer to the primary design professional, regardless of the applicable specialty or the relationship between the designer and the owner.

The architect-engineer can occupy a variety of positions with respect to the owner for whom the design is produced. The traditional and most common arrangement is one in which the architect-engineer is a private and independent design firm that produces the project design by the terms of a contract between the owner and the architect-engineer. Appendix B, AIA Document B101–2007, "Standard Form of Agreement between Owner and Architect," provides an example of a typical contract that might be entered between the owner and an architect, as written by the American Institute of Architects (AIA), which is the primary national professional association for architects.

Many public agencies and large corporate owners maintain their own in-house design capability. In such instances, the architect-engineer is a functional part of the owner's organization. In other instances, the owner contracts with a single party for both design and construction services, in an arrangement referred to as design-construct or design-build. In this arrangement, the architect-engineer is a branch of, or is affiliated in some way with, the construction contractor.

There are also arrangements where large industrial firms have chosen to reduce their in-house design staffs and have established permanent relationships with outside architect-engineers. Such "corporate partnerships" call on the architect-engineer to provide a broad range of design, engineering, and related services on an open-ended basis. Such arrangements are said to work to an owner's advantage by fostering a team approach and reducing litigation between the parties.

1.4.3 Engineering Consultants

As was noted in the previous section, construction projects have an architect or an engineer as the primary designer. Typically, a variety of engineering consultants are called upon by the primary designer to input their expertise into the design effort for certain elements of the design. If the primary designer for a building construction project is an architect, a civil engineer will typically provide services for site work, drainage, and streets and driveways; a structural engineer may be retained to perform design and analysis on the structural system for the building, or on individual structural members; a mechanical engineer may design or assist with the design of heating, ventilating, and air conditioning

equipment or systems in the building. Other engineers may be called upon to provide oversight or specific assistance with other aspects of the building design, as well.

These engineers typically enter a contract with the primary designer for the provision of their assistance and are typically paid by the primary designer. In other instances, the owner may contract with engineering consultants, whose work then provides input to the design. A typical example in building construction is the owner's providing geotechnical engineering services, whereby the soils at the site are sampled, analyzed, and tested, and where the geotechnical engineer provides both soil investigation and testing information and, frequently, his professional recommendation regarding the type of foundation system that will be suitable for the building to be designed. This information then is made available to the building design architect or engineer who will design the foundation.

1.4.4 Other Consultants

In the same fashion as noted previously, a variety of consultants may be utilized by the primary designer or by the owner to provide their expertise with specific portions of the design. Examples include lighting consultants, acoustical consultants, and the like.

1.4.5 Construction Manager

The construction manager is a professional who enters a contract with the owner, and by the terms of that contract provides a variety of different services to the owner. The concept of construction management became part of the design and construction process some years ago at a time when design-bid-build was the predominant project delivery method, whereby owners entered contracts with architect-engineers to produce the design, and contractors then submitted bids or proposals with their prices for constructing that which was designed, with one of the bidding contractors then selected for a construction contract to build the project. A number of owners saw value within this process in entering a contract with a third party to represent the owner's interests in the owner's contract with the architect-engineer and in his contract with the construction contractor. Construction management contracts were utilized when the concept originated and continue to be used today, in both the single-contract system and in the separate-contracts system. These methods of contracting are discussed more fully in subsequent sections of this chapter.

As the use of construction management contracts has continued and evolved, a variety of different services have come to be included in these contracts. The fact that the concept has endured and has evolved into several variations is indicative of the fact that owners have recognized, and are willing to pay for, a series of services beyond those defined in traditional historical design contracts and construction contracts.

Construction management services may be performed by design firms, contractors, and professional construction managers. Such services range from providing professional advice and counsel to the owner, to coordinating contractors during the construction phase, to broad-scale responsibilities over project planning and design, design document review, construction scheduling, value engineering, cost monitoring, and other management services. The demand for construction management services has increased greatly in recent years as owners have identified new needs, financial approaches, and construction technologies. Selection of the construction manager by the owner is sometimes accomplished by competitive bidding, using both fee and qualifications as the basis for contract award. In the usual instance, however, the construction management contract is considered to

be a professional services contract and is negotiated. These contracts usually provide compensation for the construction manager on the basis of a fixed fee or percentage of construction cost, plus reimbursement of management costs.

As the construction management concept has evolved, construction management has come to be defined in two basic variations: construction management agency (CMA) and construction management at risk (CMAR). In the construction manager as agent arrangement, the construction manager enters a contract with the owner, and by the terms of that contract, he represents the owner's interests in the owner's contracts with the architect-engineer and with the prime contractor(s). The construction manager has no contractual relationship with the architect-engineer or with the general contractor(s); he provides his counsel and assistance to the owner, and the owner then decides whether to take action. The construction manager as agent is illustrated in Figure 1.2.

In the CMAR contract form, the construction manager enters a contract with the owner whereby he has the responsibility for completing the construction project on time, at or under the stipulated price or the guaranteed maximum price. Often, this form of construction management contract is written by the owner in such a way that the construction manager can also provide consulting services to the owner during design, and the construction manager may actually assist the owner in the selection of the design firm.

In CMAR, the construction manager effectively acts as the general contractor during construction. The CMAR contract form may be utilized in both the single- and separate-contracts systems, as noted in Figure 1.3, and may also be used in the design-build method of project delivery, which is discussed in a subsequent section of this chapter. Thus, the construction management firm frequently has responsibility for delivery of the project to the owner, from the onset of design through final completion of the project.

At the present time, construction management (CM) is extensively utilized in this country by both private and public owners. During its early evolutionary period, confusion existed as to just what the duties and responsibilities of the CM were, what type of business firm was best qualified to perform such services, and how traditional construction relationships and responsibilities would be changed when the system was used. Some problems arose early, following the introduction of the construction management concept, concerning the lack of a practical code of ethics and standards of practice, uncertainty about liabilities of the participants, and the absence of standard contract documents to cover the wide range of CM services being provided by engineers, architects, contractors, and other parties. However, time and experience have served to stabilize this form of construction project delivery.

The Construction Management Association of America (CMAA) is a professional association which has, since its inception, been engaged in developing an accepted professional identity for construction managers and uniform standards for CM practice. In 1986, the CMAA published its standards of practice for construction managers. These standards serve as a guide to CM services and propose criteria for, and measurements of, a construction manager's performance. They describe the component elements of CM practice and define the scope of CM services. CMAA has also developed a series of standard CM contract documents.

1.4.6 The Prime Contractor

The prime contractor is defined as a business firm that has a contract with the owner for the construction of a project, either for the entirety of the project or for some stipulated portion thereof. As defined previously, the prime contractor thus has privity of contract with the owner.

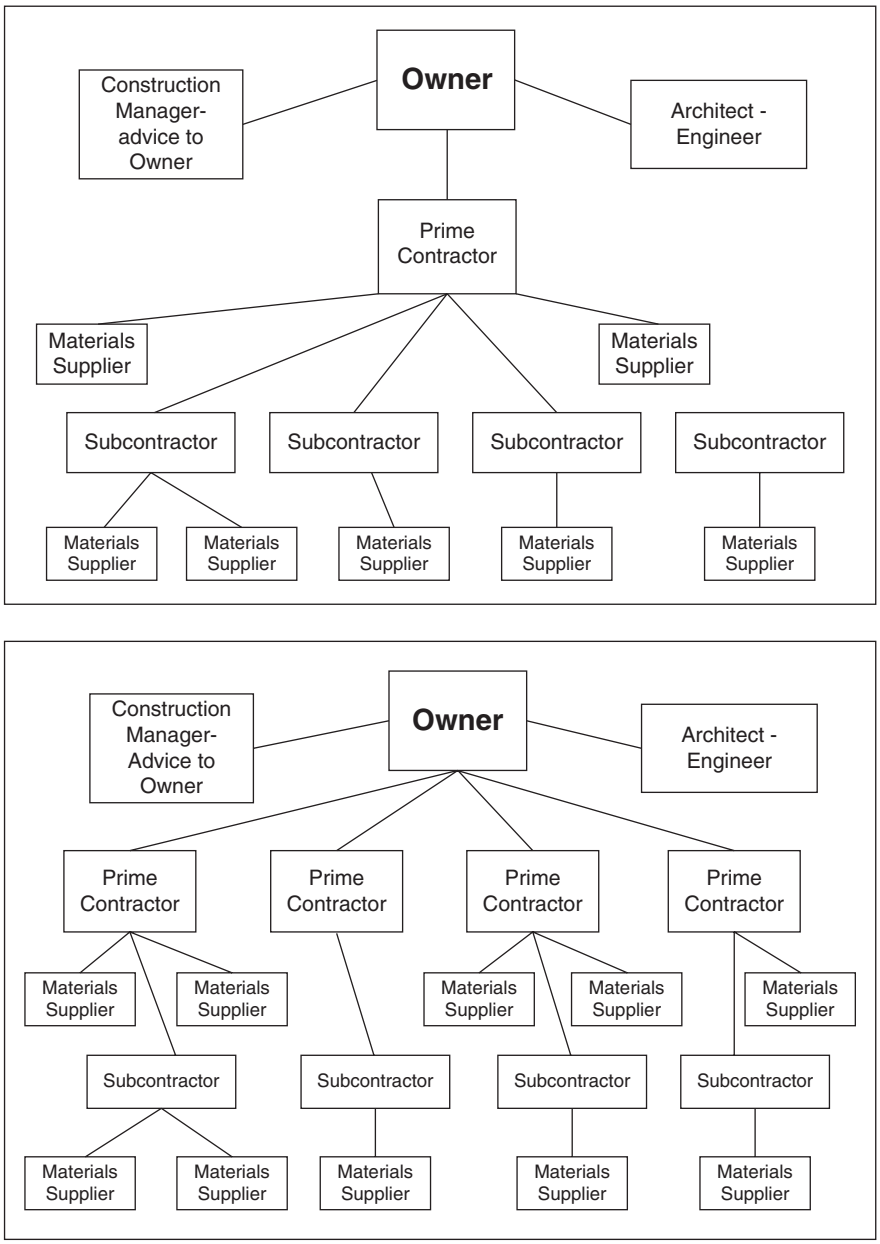

Figure 1.2 Construction Manager as Agent in Single- and Separate-Contracts Systems

While they are referred to in the context of contract formation as the prime contractors, in business practice these contractors refer to themselves by a variety of names. Many choose the term *general contractor* to indicate that they are generalists in construction practice, interested in and capable of performing different kinds of projects. Other prime contractors identify themselves in terms of the kind of work they prefer to perform, and take on names such as

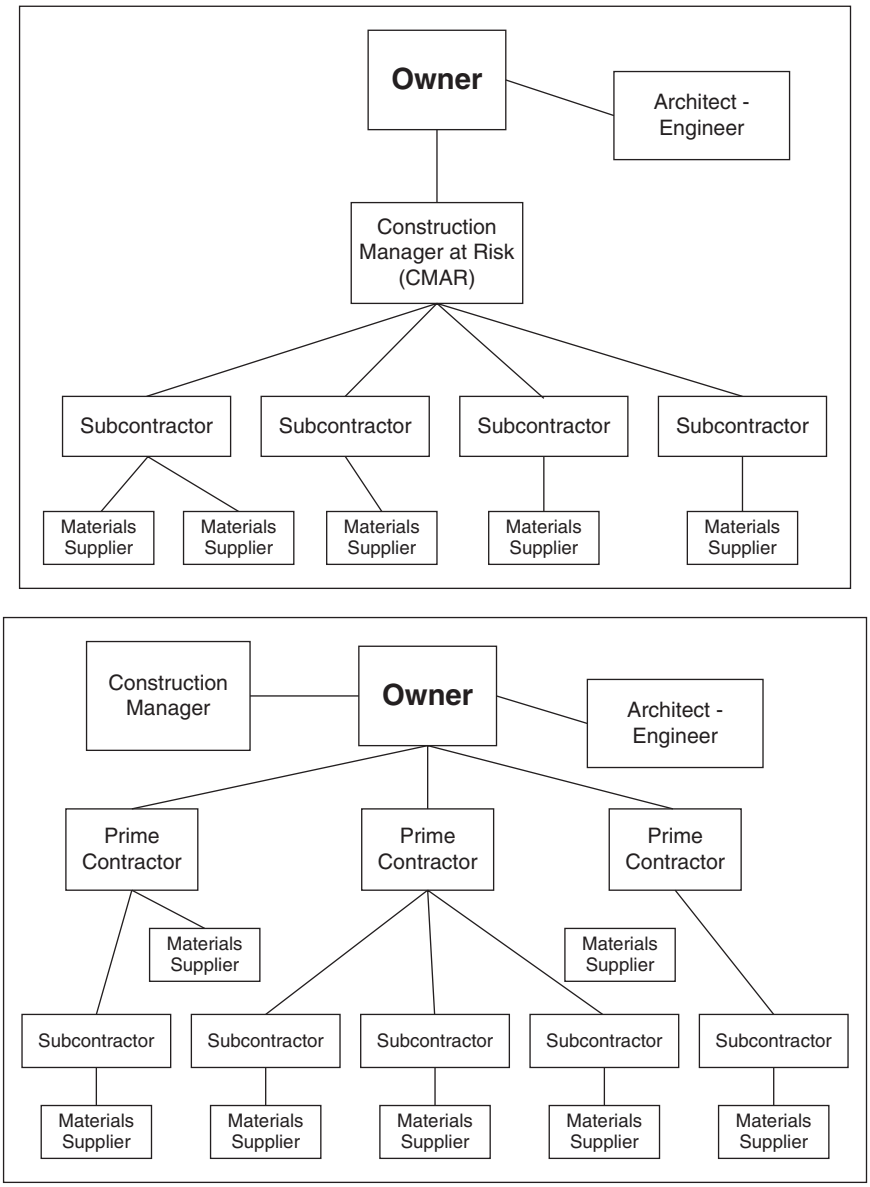

Figure 1.3 Construction Manager at Risk in Single- and Separate-Contracts Systems

highway contractors, heavy construction contractors, building contractors, residential contractors, and so on. These various types of construction contracting will be defined and discussed in subsequent sections.

On most construction projects, there is one prime contractor. This contracting arrangement is referred to as the single-contract system. In this system, the prime contractor is that party who brings together all of the diverse elements and inputs of the construction process into a single, coordinated

effort. The single prime contractor and single-contract system will be discussed in more detail in subsequent sections of this chapter.

The essential function of the prime contractor is management control and coordination of the entire construction process. Ordinarily, this contractor is in complete and sole charge of the field operations on a project, including the procurement and provision of necessary construction labor, materials, and equipment, and the management of the entirety of the construction process. Additionally, the prime contractor will usually enter contracts with a number of subcontractors, who will perform portions of the work on the project and will be responsible for managing and coordinating their work on the project.

The chief contribution of the prime contractor to the construction process is the ability to marshal and allocate and manage all of the resources required for construction of the project in order to achieve completion at maximum efficiency of time and cost. A construction project presents the contractor with many difficult management problems. The skill with which these problems are met determines, in large measure, how favorably the contractor's efforts serve its own interests as well as those of the project owner.

1.4.7 The Subcontractor

A subcontractor is a construction firm that contracts with a prime contractor, that is, has privity of contract with the prime contractor for the performance of a stipulated portion of the work on a project. Subcontractors are also frequently referred to as specialty contractors.

Economic facts, along with the increasing complexity of construction projects, as well as the efficiencies inherent in having specialized contractors performing segments of the work on a project, have confirmed the subcontract system to be an efficient and economical resource for use on construction projects of all kinds. The operations of the average general contractor are not always sufficiently extensive to afford full-time employment of skilled craftsmen in each of the numerous trade classifications and specialties needed to complete the work in the field. With the advent of subcontracting, these contractors are able to keep only a limited number of full-time employees on their payroll and then can award subcontracts for the performance by a specialist of the numerous specialty crafts as the need arises.

By subcontracting, the prime contractor can obtain workers with the requisite skills when they are needed, without the necessity of maintaining an unwieldy and inefficient full-time labor force for all of the numerous and specialized crafts which are needed on construction projects today. Subcontracting firms are able to provide substantially full-time employment for their workers, thereby affording an opportunity for the acquisition and retention of the most highly skilled and productive construction tradesmen. Additionally, these skilled craftsmen and the subcontracting companies that employ them bring with them the equipment, tools, and instrumentation necessary for the specialized elements of many projects. Qualified subcontractors are usually able to perform their specialty work more quickly and at a lower cost than a general contractor could. It can also be argued that those people and the companies that employ them, who perform their specialty work on construction projects day after day, can consistently complete their work at a higher level of quality. Many of the construction specialties that are typically performed by subcontractors, such as electrical work and plumbing work, have particular licensing, bonding, and insurance requirements.

How much of the work the prime contractor decides to self-perform on the projects that he constructs, and how much of the work he performs by awarding subcontracts for the remaining elements, depends on the nature of his management plan the nature of his business organization, and the type

of construction involved. There are instances where all of the work on a project is subcontracted, with the prime contractor providing only supervision, overall project coordination and management, and perhaps general site services. Contractors who perform construction projects in this manner are sometimes referred to as *broker contractors*. At the other end of the spectrum are those projects where the general contractor does no subcontracting, choosing to self-perform the entire work with its own forces.

This occurrence is extremely uncommon today on building construction projects, although in other types of construction this practice is still followed. In the usual case, however, the prime contractor will perform some of the operations that comprise the work on the overall project and will subcontract the remainder to various specialty contractors.

When the prime contractor engages a specialty firm to perform a particular portion of the overall construction project, the two parties enter into a contract called a subcontract agreement or simply a subcontract. This subcontract agreement will pass through to the subcontractor many of the responsibilities that the prime contractor has agreed to fulfill to the owner and will stipulate the exact services the subcontractor is to provide and specific elements of the work that the subcontractor is to perform.

It should be noted that a subcontract agreement between a prime contractor and a subcontractor in no way establishes a contractual relationship between the owner and the subcontractor. The prime contractor, by the terms of its contract with the owner, assumes complete responsibility for the direction and control of the entire construction project. An important part of this responsibility is coordinating and supervising the work of the subcontractors. When the general contractor subcontracts a portion of the work, this contractor remains completely responsible to the owner for the total project and is liable to the owner for any negligent performance of the subcontractors. However, the courts have ruled that, in the absence of provisions in the general contract holding the prime contractor responsible for the negligence of its subcontractors, the contractor cannot be held liable for damages caused by the collateral torts of its subcontractors.

In private construction, the prime contractor generally decides how much of the work on a project he will self-perform with people on his payroll and under his direct supervision, and how much of the work he elects to perform by subcontracting. However, on some private construction projects and frequently on public construction projects, the owner imposes a limitation on the proportion of the total construction on the project that the prime contractor is allowed to subcontract. For example, several federal agencies have set such limitations. Additionally, some states have established statutory restrictions on the subcontracting of public works in those states. Such limitations on construction subcontracting are intended to circumvent any of a number of potential problems associated with extensive subcontracting. An extensive number of subcontracts on a project can lead to problems such as division of project authority, fragmentizing responsibility, complicating the scheduling of job operations, adding to the difficulties of coordinating construction activities, weakening communication between management and the field, fostering disputes, and generally impeding to job efficiency. Obviously, the extent to which these difficulties may actually occur is very largely a function of the experience, organization, and management skill of the prime contractor involved.

1.4.8 The Sub-subcontractor

A sub-subcontractor is one who enters a contract with a subcontractor on a project for the performance of a stipulated portion of the subcontractor's work. Sub-subcontractors may be engaged when a subcontractors is not capable of, or may not be interested in, performing all of the work in its scope of work as defined in the subcontract agreement with the prime contractor. While sub-subcontracting

is sometime performed, for the same reasons described in the preceding paragraphs, many owners limit whether and to what extent sub-subcontractors may be utilized on a project. In the same way, many prime contractors include language in their subcontract agreements limiting sub-subcontracting on the part of subcontractors.

1.4.9 Vendors

Vendors, also referred to as materials suppliers, are those who provide materials or products for inclusion in a project. They do not provide services or labor for the installation of the materials in a project, and furnish only materials or other products. They generally do so by the terms of a sales contract, purchase order, or purchase agreement that they enter with a prime contractor, subcontractor, or sub-subcontractor.

1.5 CONSTRUCTION CATEGORIES

The field of construction is as diversified as the uses and forms of the many types of the end products that it produces. While the several types and categories of construction can be classified in different ways, construction is commonly divided into four main categories: residential construction, commercial construction, heavy/civil/highway construction, and industrial construction. It should be noted, however, that some of these categories may be subdivided and described in other terms, and also that there is some overlap among these divisions and that certain projects do not fit neatly into any one of them.

In general, contracting firms tend to specialize with regard to the types of work they perform, and therefore typically perform most of their work within one of these divisions or one of the subdivisions to be described later. This specialization is usual and necessary because of the radically different equipment requirements, construction methods, trade and supervisory skills, contract types and provisions, and financial arrangements involved with the different construction categories. The four main divisions—residential, commercial, heavy/civil/highway, and industrial—are further described in the following paragraphs.

1.5.1 Residential Construction

Residential construction, also referred to as housing, includes the building of residences of all kinds. Included in this category are those who build single-family homes; duplexes; condominiums; multiunit townhouses; low-rise, garden-type apartments; and high-rise apartments. Design of this construction type may be performed by the owners themselves, by architects, or by the builders themselves. Although a number of very large national residential building firms are engaged in various forms of residential construction, this category of construction is dominated by small building firms.

Residential construction typically accounts for about 40 to 50 percent of new construction during a typical year. Historically, residential construction has been characterized by instability of market demand and is strongly influenced by governmental regulation and national monetary policy. Residential construction is also an area of construction typified by periodic high rates of contractor business failures.

A significant proportion of housing construction is financed through private financial lending institutions, while government or quasi-government agencies, such as the Department of Housing and Urban Development (HUD), the Federal Housing Administration (FHA), the Federal National

Mortgage Association (FNMA, or "Fannie Mae"), the Government National Mortgage Association (GNMA, or "Ginnie Mae"), and Veterans Affairs (VA), also provide mortgage financing or mortgage guarantees for residential construction.

Within this category, some residential contractors are speculative builders and others are custom builders, while some residential contractors construct both speculative and custom units. Speculative builders are those who construct a residential building in the role of owner-builder. They acquire real estate and a design for a residence, and then they build the facility and offer it for sale. Their business plan is to sell the property to a new owner during, or soon after completion of, the construction.

Custom residential builders are those who construct a residence for an owner by the terms of a contract between the owner and the builder. The owner will typically own the real estate on which the residence will be built, and usually the owner will have obtained a design for the facility to be constructed, either from the builder, from an architect, or from some other source.

1.5.2 Commercial Construction

Commercial construction in the commonly understood sense includes buildings constructed for institutional, educational, light industrial, business, social, religious, governmental, and recreational purposes. Some refer to the construction of churches and schools within this category as *institutional construction*.

Design of the buildings in this construction category is performed predominantly by architects, with engineering design services and consulting services being obtained by the architect for input to the design as needed. Construction of this kind is generally performed by prime contractors or construction managers who typically subcontract substantial portions of the work to specialty firms. Both the single- and separate-contracts systems may be used.

Contractors who perform commercial construction typically refer to themselves as building contractors or as general contractors. In normal business years, private capital finances most commercial construction, which normally accounts for 20 to 30 percent of the annual total volume of new construction.

1.5.3 Heavy/Civil/Highway Construction

Almost all of the facilities described with these terms are designed by an engineer, rather than by an architect, and therefore construction of this kind is often broadly referred to as *engineered construction*. This category includes those structures whose design usually is concerned more with functional considerations than aesthetics and involve field materials such as earth, rock, steel, asphalt, concrete, timbers, and piping. Engineered construction is also characterized by the utilization of numerous major items of construction equipment, and projects of this type are characterized by large spreads of this equipment, such as power shovels, tractor-scrapers, pile-drivers, draglines, large cranes, heavy-duty haulers, paving plants, rock crushers, and associated equipment types.

In a general sense, heavy construction typically includes the design and construction of facilities such as power plants, dams, levees, freshwater treatment plants, wastewater treatment plants, desalinization plants, aqueducts, flood control structures, canals, railroads, airports, tunnels, port and harbor facilities, and the like. Most people would use the term *civil construction* to describe the design and construction of water, gas, and electrical utility lines; telephone distribution facilities; streets; curbs and gutters; storm drains; and so on. Highway and airfield construction refers to clearing, excavation, fill, aggregate production, sub-base and base, paving, drainage structures, bridges, traffic signs, lighting systems, and other such items commonly associated with this type of work.

It should be noted that the distinctions between the categories of engineered construction described earlier are not exact. There is a considerable amount of overlap, and some contractors who perform these types of work may refer to themselves with different identifying labels. For example, some highway contractors would routinely include the construction of bridges within their scope of work. Others might award bridge construction to separate contractors or to subcontractors, while some other contractors specialize in the construction of bridges as their primary business. Similarly, some municipal storm drains might be constructed by contractors who refer to themselves as heavy construction contractors, while others performing similar work might call themselves civil construction contractors.

Most engineered construction projects of the kind described here are publicly financed, and therefore are also frequently characterized as public construction projects. Projects of the kind described in this section in the aggregate account for approximately 20 to 30 percent of the new construction market.

1.5.4 Industrial Construction

Industrial construction includes the erection of projects that are associated with the manufacture or production of an industrial product or service. Such structures are frequently highly specialized and highly technical in nature, and are typically built by large, specialized contracting firms that perform both the design and field construction. Typical examples of this type of construction are petroleum refineries and process plants of all kinds. Almost all of this type of construction is designed by engineers rather than by architects. In addition to an engineer producing the primary design, other engineering firms, and sometimes a variety of consulting firms, assist with specific elements of the design.

While this category accounts for only 5 to 15 percent of the annual volume of new construction, it includes some of the largest projects built. In the United States, a very large proportion of this category of construction projects is privately financed.

1.6 PROJECT FINANCING

1.6.1 By Owner

As noted in a previous section, the owner makes the necessary financial arrangements for the construction of most construction projects. This normally requires obtaining the funding from some external source. In the case of public owners, the necessary capital may be obtained by tax revenues, appropriations, or bonds. A large corporate firm may obtain the funds by the issuance of its own securities, such as bonds. For the average private owner, funding is normally sought from one of several possible loan sources, such as banks, savings-and-loan associations, insurance companies, real estate trusts, or government agencies.

Where construction funding is obtained by commercial loans, the owner must typically arrange two kinds of financing: (1) short-term financing, also referred to as interim financing, or as construction financing, to pay the construction costs; and (2) long-term financing, also referred to as mortgage financing, which is repaid over a longer term. The short-term financing involves a construction loan and provides funds for land purchase and project construction. The term of a construction loan usually extends only for the construction period and is typically granted by a lending institution with the expectation that it will be repaid at the completion of construction by some other loan such as

the mortgage financing. The term of the mortgage loan is usually for an appreciable period such as 10 to 30 years. Usually, the first objective of the project owner is to obtain the commitment for the long-term or permanent financing from a lender. Once this commitment is arranged, the construction loan is then typically arranged.

When the mortgage lender has approved the long-term loan, a preliminary commitment is issued. Most lenders will not give the final approval for the loan commitment until they have reviewed and approved the project design documents. Upon final approval, the mortgage lender and the borrower enter into a contract, and by the terms of that contract the project owner promises to construct the project according to the approved design, and the lender agrees to provide the funds for the stated period of time.

When a commitment for the long-term financing has been arranged, the construction loan is obtained. Commercial banks and savings-and-loan associations are common sources for such financing. To obtain this loan, the owner may be required to name its intended design firm and the contractor who will perform the work. Lending institutions typically limit their construction loans to no more than 75 to 80 percent of the estimated cost of construction. Thus, the owner is required to commit his equity in the amount of 20 to 25 percent of the contract amount. When the construction loan has been approved, the lender sets up a "draw" schedule that specifies the rate at which the lender will make payments to the contractor during the construction period. Typically, the short-term construction loan is paid off by the mortgage lender when the construction is completed. This repays the construction loan, and the mortgage is finalized, and the owner is left with the long-term obligation to the mortgage holder.

1.6.2 By Builder-Vendor

A builder-vendor is a business entity that designs, builds, and finances the construction of structures for sale to the general public. The most common example of this is tract housing, where the builder-vendor acquires land and builds housing units. This was referred to earlier as speculative residential construction, where the builder-vendors act as their own prime contractors, build dwelling units on their own accounts, and often employ sales forces to market their products. They intend to sell the residential property during the course of construction of the project or soon after the completion of the project. Hence, the ultimate owner incurs no financial obligation until the structure is finished and a decision to purchase the building is made.

In much of this type of construction, the builder-vendor constructs for an unknown owner. Many builder-vendors function more as construction brokers than construction contractors per se, often choosing to subcontract all or nearly all of the actual construction work. The usual construction contract between owner and prime contractor is not present in such cases because the builder-vendor occupies both roles. The source of business for the builder-vendor is entirely self-generated, as opposed to the professional contractor, who obtains its work in the open construction marketplace.

1.6.3 By Developer

A developer acquires financing for the owner's project in two different ways. A comparatively recent development in the construction of large buildings for business corporations and public agencies is the concept of design-finance. In this case, the owner teams up with a developer firm that provides the owner with a project design and a source of financing for the construction process. This procedure minimizes or eliminates altogether the initial capital investment of the owner. Developers are invited

to submit proposals to the owner for the design and funding of a defined new structure. A contract is then negotiated with the developer of the owner's choice. After the detailed design is completed, a construction contractor is selected and the structure is erected.

The second procedure used by developers is currently being applied to the design and construction of a wide range of commercial structures. Here, the developer not only arranges project design and financing for the owner but is also responsible for the construction process. Upon completion of the project under either of the two procedures just discussed, the developer sells or leases the completed structure to the owner.

1.7 THE CONTRACT SYSTEM

The owner of a proposed construction project has many different options available as to how the work is to be accomplished. It is true that public owners must conform to a variety of statutory and administrative requirements in this regard, but the construction process is a flexible one, offering the owner many choices as to procedure.

In the usual mode of accomplishing construction work, the prime contractor enters into a contract with the owner. The contract describes in detail the nature of the construction to be accomplished and the exact services that are to be performed. The contractor is obligated to perform the work in full accordance with the contract documents, and the owner is required to pay the contractor as agreed in the contract.

Experience has shown that owners can often reduce their construction costs by giving careful thought to the type of contract that best suits their requirements and objectives. The chances for a successful construction process are enhanced by thoughtful and thorough study by the owner before the process is initiated. The careful analysis and consideration of risk during the field construction is a critical issue. Typical contract choices force either the contractor or the owner to bear most of the risk. Each of these contract types has its advantages, but there are variations that apportion construction risks to the party that can best manage and control them.

The means by which the prime contractor is selected, the form of contract used, and the scope of duties thereby assumed by the contractor can be highly variable, depending on the preferences and requirements of the owner. Architects, engineers, and construction managers may provide consultation and assistance to the owner in this regard; however, it is the owner who will ultimately make the decisions. The prime contractor may be selected on the basis of competitive bidding, or the owner may negotiate a contract with a selected contractor, or perhaps a combination of the two may be used. The entire project may be included within a single contract, or separate prime contracts for specific portions of the work may be used. The contract may include project design as well as construction, or the contractor's responsibility may be primarily managerial. The owner may or may not utilize the services of a construction manager, and these services may vary in scope and description. It is to be emphasized here that the owner is the key participant here and is the person who will make these decisions.

1.8 PROJECT DELIVERY METHODS

1.8.1 Construction Services Only

A large percentage of construction contracts provide that the general contractor has responsibility to the owner only for the accomplishment of the field construction. Under such an arrangement, the contractor is completely removed from the design process and provides no input to the design.

The contractor's obligation to the owner is limited to constructing the project in full accordance with the terms of the construction contract.

Where the contractor provides construction services only, the owner may have an in-house design capability. The more common arrangement, however, is for a private architect-engineer firm to perform the design by the terms of a contract with the owner. Under this latter arrangement, the design professional acts essentially as an independent contractor during the design phase and as an agent of the owner during construction operations. The architect-engineer acts as a professional intermediary between the owner and contractor and often represents the owner in matters of construction contract administration. Under such contractual arrangements, the owner, the architect-engineer, and the contractor play narrowly defined roles, each performing a particular function semi-independently of the others.

1.8.2 Design-Bid-Build

The design-bid-build project delivery method has for many years been the most commonplace method of project delivery for construction projects of all kinds. The process derives its name from the sequence in which the design and construction functions are performed. This project delivery method is also referred to as linear construction or as design-then-construct.

In the design-bid-build project delivery method, the process begins with the owner's perceiving a need for the construction of a facility. Typically, the owner considers financing and budget for satisfying the need he has recognized. The owner subsequently enters a contract with an architect or engineer, who will provide complete design services. The designer's basic responsibility as typically defined by the owner is the creation of an original design for a construction project that will satisfy the needs of the owner, within the owner's budget.

The owner's contract with the designer usually includes responsibility for production of a complete set of drawings and specifications that will communicate the design to the owner as well as to the contractor and will define the deliverables in the construction contract. Additionally, complete design services usually include the designer's authorship of all of the bid documents and contract documents for the project. The typical content of the set of bid documents and contract documents for a project is depicted in Figure 1.4.

In addition to providing the services noted earlier, the architect-engineer who is the primary designer will typically provide contract administration services during construction, and representation of the owner's interests through observation of the work during construction, as well as closeout of the project and administration of any warranty issues after construction is complete. As previously noted, the exact nature of the services to be provided is set forth in the contract between the owner and the architect-engineer.

When all of the bid documents and contract documents have been produced and have been approved by the owner, the designer assists in announcing the project to construction contractors by means of an advertisement for bids, an invitation to bid, or a notice to bidders. Through these documents, contractors are made aware of the existence of the project, and are provided a brief description of the project and the form of contract to be employed. Additionally, the contractors are provided information with regard to how to obtain bid documents and contract documents, and are informed with regard to the date, time, and place where contractors' proposals are to be submitted.

The architect-engineer administers the process of making bid documents and contract documents available to the contractors. In addition, the designer will answer contractors' questions, and will provide interpretations and clarifications regarding the information in the contract and bid documents as requested, during the time when contractors are preparing their estimates, which is known as the bid

BID DOCUMENTS

1. Advertisement for bids, notice to bidders, invitation to bid
   Instructions to bidders
   Proposal form

CONTRACT DOCUMENTS

1. Conditions of the contract
   - General conditions
   - Modifications to the general conditions
   - Supplementary general conditions
   - Special conditions
2. Drawings
3. Specifications
4. Addenda
5. Alternates
6. Agreement
7. Modifications
   - Amendment
   - Change order
   - Construction change directive
   - Written order for a minor change

Figure 1.4 Bid Documents and Contract Documents for a Construction Project

period. Additionally, the architect-engineer will respond to written requests for information (RFIs) from the contractors during this period.

In addition, the designer will issue addenda as he deems necessary during the bidding period. An addendum (plural: *addenda*) is any modification to any provision of the contract documents or the bid documents for the project, issued by the designer during the bidding period. Addenda are issued in consecutively numbered sequence, and the designer will assure that he sends each new addendum to all of the contractors who have received bid documents and contract documents. Usually, when addenda are issued during the bidding period, the architect-engineer will require written and signed acknowledgment from each contractor on their proposal submitted on bid day that they have received and considered all of the addenda issued, identified by number.

The designer will usually administer the process of receiving the contractors' proposals on bid day, and will conduct the bid-opening process. The architect-engineer will then assist the owner with selection of the contract recipient and with execution of the agreement between the owner and the contractor.

After the contract has been signed between the owner and the contractor, the contractor will proceed to performance of the contract requirements. Throughout this time, the architect-engineer will provide contract administration services for the owner as defined in the owner-architect contract.

1.8.3 The Team Approach

An appreciable share of the private construction market is now utilizing the "team approach" for construction project delivery. This method of project delivery may also be referred to as integrated project delivery. When this method is followed, the private owner selects and enters agreements with the architect-engineer and the building contractor as soon as the project has been conceived. From this point forward, the three parties constitute a team that serves to achieve budgeting, cost control, time scheduling, and project design and construction in a cooperative manner.

Using the team approach, the owner assembles his key players, architect-engineer and contractor, to study the proposed project. The team determines the project program, and formulates project scope and budget, and the designer develops preliminary drawings from which the contractor makes conceptual cost estimates. As the process continues, the designer prepares the final drawings and specifications, and the contractor prepares more detailed estimates, and the owner makes the necessary financial arrangements. After financial commitments and required permits are obtained, the actual construction begins. During the course of construction of the project, the designer and contractor work closely together, modifying the design and drawings as may be required. The process offers the owner the advantages of time savings, cost control, and improved quality.

Where the team approach is used, the owner is mainly responsible for setting goals and parameters of the project, as well as providing the funding. The architect-engineer is responsible for developing the functional, aesthetic, and technical features of the building, and for preparing complete drawings and specifications in this regard. The contractor contributes its expertise in building materials, construction methods, construction costs, subcontractor coordination, and project scheduling.

1.8.4 Design-Build

The design-build method of project delivery has been rapidly gaining in popularity as well as in commonness of use in recent years. Most professional practitioners believe that this project delivery method will soon become the most prevalent method for delivery of design and construction services, certainly for buildings, and perhaps for other categories of construction as well. Some believe that the use of the design-build method has already surpassed the use of the design-bid-build method of project delivery for building construction.

The design-build method may also be referred to as the turnkey process or as the turnkey project delivery method. In the design-build system, the owner enters one contract with a single professional entity, and that firm has the responsibility for providing both design and construction services for the owner.

The design-build method of project delivery hearkens back to the days many years ago when there was a master builder who provided both design and construction services to the owner. Today, the design-build firm may be an architecture or engineering firm that is collaborating with, or has entered a partnership arrangement or a joint venture arrangement with, a contracting firm to provide design-build services. Or it may be a construction firm that has a collaboration agreement with a design firm, or a construction company that has in-house design capability. Additionally, some construction management firms (to be discussed in the next section) sometimes offer both design and construction capability.

The frequency of owners choosing to utilize the design-build method is explained by the fact that there are numerous benefits to be derived by the owner through his use of this method of project delivery. Perhaps the most important of these benefits is the inherent communication and collaboration that are central to this process, between those who will produce the design for the project and

those who will perform the construction, from the inception of the project to final completion. The contractor's understanding of all aspects of the construction process, as well as his knowledge of construction materials and methods, and connections and details, in addition to his understanding of costs and his knowledge of estimating and scheduling, are important assets that he can bring to the project and that can be provided as input to the design process, beginning at the time the project is first conceived.

Additionally, when owners utilize the design-build method of project delivery, they derive the benefit of one firm's having singular responsibility to the owner for all aspects of both the design and construction. By contrast, in the design-bid-build system, designers usually produce the design, as well as authoring the bid documents and contract documents for the project, without any assistance or input from a contractor. Sometimes, after the construction contract is formed, there are miscommunications and misunderstandings and, at times, disputes between the designer and the constructor regarding various elements of the project design or with regard to a variety of different contract issues. This may lead to delays, additional costs, and perhaps claims. Additionally, when there is conflict, these occurrences leave the owner, who simultaneously has a contract with both the designer and the constructor, in the uncomfortable position of not knowing which of the professionals whose services he has engaged is correct. Owners who have endured such an experience are quick to say that the design-build method, with its single-point responsibility for all design and construction issues residing in one firm, can provide a significant benefit to the owner. Many owners are electing to utilize this design-build method of project delivery today, because of the numerous benefits that this method can provide for the owner.

1.8.5 Design-Manage

Design-manage is a term sometimes used to refer to a single-source construction service utilized by some owners. Design-manage is an arrangement where the owner enters into a single contract for both design and construction management services. In this arrangement, a single entity both designs the project and acts as a construction manager during the construction phase. A design-manage arrangement is often the result of a joint venture (see Chapter 2) between a design firm and a construction management enterprise.

With design-manage, the construction is typically performed by a number of independent contractors in contract with either the owner or with the design-manage firm, with the design manager planning, administering, and controlling the construction process. As is the case with design-construct and construction management, design-manage can, and usually is, utilized in fast-track construction. Fast-track construction is discussed further in another section of this chapter

1.8.6 Preengineered Buildings

Recent years have seen a large increase in the application of a specialized form of design-construct. Referred to as *preengineered* or *systems* building, this construction mode is now applied to a wide range of building types, from industrial applications to office buildings, retail centers, institutional buildings, and government-owned facilities.

Intended to provide an architecturally appealing building to meet an owner's specific requirements, this is a specialized design-build arrangement where the contractor is a dealer in metal structural systems and is directly affiliated with the manufacturer. The contractor, architect-engineer, and building manufacturer work closely together to create a finished project that serves the owner's needs

in optimum fashion. Owners have found that preengineered metal buildings offer a competitive price along with a great deal of design flexibility. Such metal buildings now account for a significant share of the low-rise commercial and industrial construction market in this country. The Metal Building Manufacturer's Association (MBMA) is a national trade association of such producers.

Initially, preengineered buildings consisted of standard modules, but in today's market essentially every metal building system is custom engineered to meet the owner's specific requirements. The producer now has the ability to custom fabricate systems to fit specific project criteria. Manufacturers can fabricate complete metal buildings and multistory structural systems, including the framing, metal roof, walls, finishes, partitions, and necessary subsystems. These preengineered packages are presized, precut, and ready to be assembled on-site into a fully integrated building unit.

The component parts are shipped to the job site where the building is assembled and anchored to the foundation by a local contractor. These are metal building "builders" or "dealers" who are usually formally affiliated with the manufacturer and are usually full-service contractors assigned to serve a given geographical area. Many metal building contractors also market their product and services as subcontractors to other general contractors.

Metal buildings can be manufactured using many different exterior wall materials. A single manufacturer usually supplies a complete package of integrated building components that arrive at the job site ready for assembly and erection. Systems building of this kind has proven to have the advantages of speed of construction, design flexibility, high quality, economy, minimal maintenance, and relative ease of future expansion. Collectively, these features have led to a widespread acceptance of metal building systems by owners, as well as by other construction buyers and specifiers.

1.8.7 Fast-Track

Fast-track is a method of project delivery that is sometimes employed when the objective is to reduce to a minimum the time required for design and construction of a project. This method is also referred to as phased construction. Fast-track involves the assumption of considerable risk on the part of the owner, with the objective of reaping a return in dollars and/or time sufficient to justify the exposure or risk that is inherent in the method.

In fast-track construction, the design and construction functions for parts or phases of the project are "leapfrogged" with one another. Instead of awaiting the start of construction until a completed design for the entire project has been produced, fast-track applies a logic of designing one part or phase of the work and, as soon as that design is complete, awarding a construction contract and beginning construction on that phase.

While construction is under way on that part or phase, design proceeds on the next phase of the project, with the objective of having that design completed by the time construction is complete on the preceding phase or by the time the project is ready for construction on the second phase to begin. Then a construction contract is awarded for the most recently designed segment; at the same time, design proceeds on the next phase. This process continues until the project is complete.

For example, on a building construction project, with some basic information in hand, and with some assumptions made with regard to other aspects of the design of the building and the complete facility, site work and utility design can be completed and a construction contract awarded for this phase. While that work is under way, design of the foundation for the building commences. Again, some basic determinations will have been made regarding building size and footprint, structural loads, and so on, sufficient to allow a proper foundation design. As soon as that design is complete, and as soon as there will be no interference with site work and utilities operations that may still be under

way, a foundation construction contract is awarded. While foundation construction is under way, design work continues for the building structural system. In this fashion, the design and construction functions are leapfrogged with one another throughout the project, until its completion.

The advantage of the fast-track method is that construction of the project can begin at the earliest possible time, and the construction of each phase of the building can begin without the need to wait for a complete design of the entire facility. This can significantly reduce the overall time required for design and construction.

The disadvantage, of course, is that when there is not a complete and integrated design for the project before construction commences, some retrofit may be necessary, and some work may have to be removed and replaced, or some parts of the project may be overdesigned because of the assumptions that needed to be made early, in order to allow construction to commence at the earliest time. The objective of fast-track is to have the overall time and dollar savings, which result from having the design and construction completed at the earliest possible time, be sufficient to compensate for the errors and the retrofit and "tear-out and redo" that may result from not having a complete and integrated set of design documents in hand prior to the onset of construction, so that in the end there is a net gain for the owner.

Design and construction contracts for fast-track construction can be structured in a number of different ways. Frequently, though not always, fast-track projects are accomplished by use of the design-build method, as discussed in a previous section. Fast-track is most commonly employed with the separate contracts system in use. Construction management services are also frequently utilized by the owner in the fast-track method of project delivery.

Critics of fast-tracking have argued that the process emphasizes time rather than quality. Additionally, the final construction cost is unknown at the start of fast-tracked construction, which is a form of contract referred to as an open-ended contract. Further, if bids for subsequent phases of the work come in over budget, redesign options to reduce cost are very limited. Fast-track projects sometimes take longer to complete than the usual, sequential process when applied to complex projects or if the fast-track process is not properly managed. As noted earlier, fast-track involves the assumption of considerable risk on the part of the owner. Despite these problems, however, fast-tracking has proven to be a successful and desirable owner option in some cases, when properly applied and managed. It remains a viable and sometimes useful project delivery method today.

1.8.8 General Conditions Construction

In the traditional construction process, general contractors customarily provide certain common job services for a project and for the contractors on-site, not only for their own forces but for their subcontractors as well. These services, called general conditions construction, or support construction, include many items normally required and described by the general conditions section of the project specifications. They involve such services as temporary electrical power, temporary heat, fencing and gates, parking areas for construction workers, access to the project, hoisting, weather protection, guardrails, stairways, fire protection, drinking water, sanitary facilities, job security, job sign, trash disposal, and so on. When separate contracts are used, the contractor who is designated as the general contractor or the coordinating prime contractor usually provides these general conditions services for the entire project, including work performed by the other prime contractors.

There are instances in which general conditions construction is the only part of the construction process actually performed by the general contractor. This would be true, for example, when the

contractor, builder-vendor, or owner-builder subcontracts the entire project. Additionally, it should be noted that in some construction management arrangements, the construction manager provides support construction services.

1.8.9 Value Engineering

Value engineering is not as much a project delivery system as it is an accompaniment to many of the project delivery systems in use today. Value engineering may or may not be utilized on a project, at the discretion of the owner.

Conceptually, in value engineering the owner and the architect-engineer seek the input of the contractor with regard to his recommendations for alternative materials or systems, different from what the architect-engineer originally included in the design documents, which could be used on the project. The objective may be to reduce construction cost and/or to seek better value for the owner.

The circumstances in which value engineering is employed may vary considerably. Sometimes in competitive bid contracting, especially when the bids received from contractors exceed the owner's budget, the contractor who submitted the lowest proposal price will be asked to "value engineer" the project. This endeavor will be focused on the contractor's putting forth alternative materials or systems that he may recommend, which could be delivered at a lower cost than what was designed and specified in the contract documents prepared by the architect-engineer that the contractor utilized to prepare his original proposal. The architect-engineer and the owner will assess the contractor's recommendations and decide whether to accept or to reject any or all of the alternatives the contractor has put forth. For those accepted, the contract documents and the contract price will be modified accordingly.

At other times in competitive bid contracting, the contractor may be asked to submit his "value engineering" proposals as an accompaniment to his bid. These take the form of proposed alternates to the original contract documents, and again usually include the contractor's recommendations as to alternative materials or systems being proposed in lieu of what the original contract documents set forth, along with the change in price that would result from acceptance by the owner and architect.

In like fashion, sometimes in negotiated contracting and in the competitive sealed proposals method of contract formation (to be discussed later in this chapter), the contractor will submit value-engineering proposals for consideration. In each case, the contractor recommends alternative materials or systems that he believes could reduce the contract price and/or provide better value for the owner. If his recommendations are accepted by the architect and the owner, they are written into the contract agreement and are reflected in the contract price.

1.9 TYPES OF CONSTRUCTION CONTRACTS

A number of contract forms and types are available to owners for the performance of their construction projects. All call for defined services to be provided under contract to the owner. The scope and nature of such services can be made to include almost anything the owner wishes. The selection of the proper contract form appropriate to the situation is an important decision for the owner and is deserving of careful consideration and consultation. As has been noted previously, public owners must work within the strictures placed on them by applicable law. Some of the most commonly used types of construction contracts are discussed in the following sections.

1.9.1 Single-Contract System

In the single-contract system, there is one prime contractor who has a contract with the owner. This contractor is responsible to the owner for the construction of the entire project and for fulfilling all of the requirements set forth in the contract documents. The single-contract system is the most common type of contract system in use today. This contract system is illustrated in Figure 1.5 below.

In this contracting system, the distinctive function of the prime contractor is to coordinate and direct the activities of the various parties and agencies involved with the construction and to assume full, centralized responsibility to the owner for the delivery of the finished project as defined in the contract documents within the specified time defined as the project duration. Customarily, the prime contractor will construct certain portions of the project with its own forces and will subcontract the remainder of the work to various specialty contractors. The general contractor accepts complete accountability, not only to build the project according to the contract documents but also to ensure that all costs associated with the construction are paid.

The general contractor has privity of contract with the owner and is fully responsible for the performance of the subcontractors and other third parties to the construction contract. It is noteworthy that when a prime contractor sublets a portion of the work to an independent specialty contractor, the general contractor has a nondelegable duty to the owner for the proper performance of the entire work and remains responsible under his contract with the owner for any negligent or faulty performance, including that of the subcontractors. When the work is not done in accordance with the contract, the general contractor is in breach of contract and is liable for damages to the owner, regardless of whether the faulty work was performed by the contractor's own forces or by those of a subcontractor.

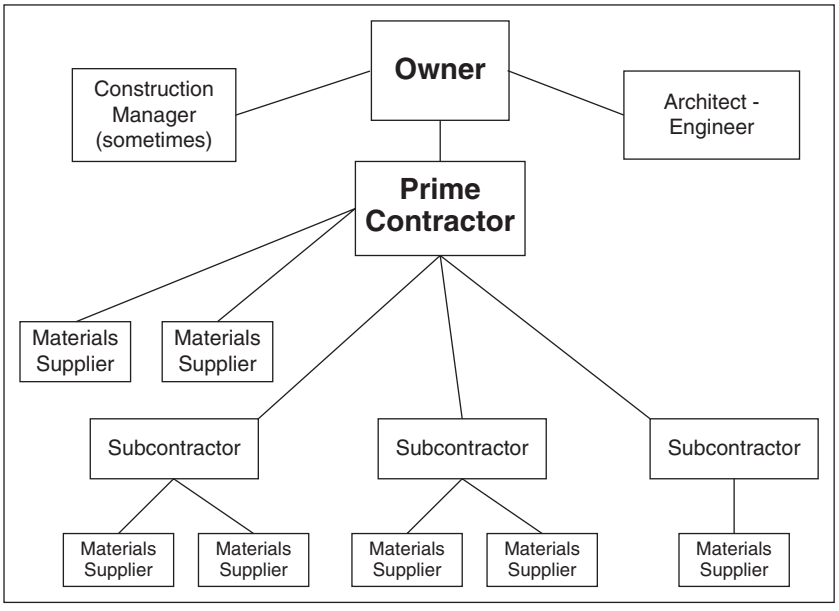

Figure 1.5 Single-Contract System

1.9.2 Separate-Contracts System

In the separate-contracts system, there is more than one prime contractor who has a contract with the owner. Each separate prime contractor is responsible for the performance of a scope of work as defined in his contract, but that scope of work includes only a specific and well-defined portion of the overall project. This separate-contracts system is illustrated in Figure 1.6.

When the separate-contracts system is employed, the owner will subdivide the project into well-defined segments, or phases, or elements of work and will define a work package for each of the various parts. This will in turn define the scope of work for each of the separate prime contracts. A separate prime contract will then be awarded for each of the work packages. Sometimes the owner performs the function of subdividing the overall work to be done and defining the various work packages and the contents of the several separate prime contracts himself, if he has the experience and the expertise necessary to do so. Alternately, the owner may rely on the expertise of the architect-engineer to define the work packages that comprise the separate contract and their scopes of work. At other times, the owner may utilize the services of a construction manager, in either a CMA or a CMAR capacity, to perform this function.

When the separate-contracts system is utilized, it is imperative that there be some method in use for providing coordination among the various separate prime contractors. Whether the owner performs this function himself or relies on the architect-engineer for assistance, or whether he utilizes the services of a construction manager to perform this function in his behalf, it is imperative to have clearly defined responsibilities and definitions of scopes of work among each of the separate work packages and each of the separate contractors. Additionally, the owner may structure the separate contracts in such a way that one of the separate contractors is designated as the "coordinating prime contractor."

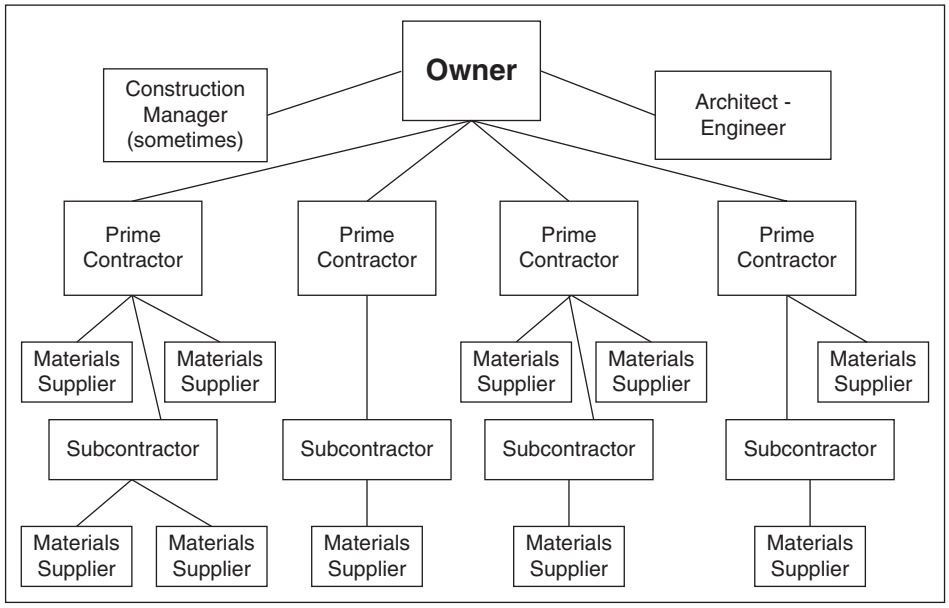

Figure 1.6 Separate-Contracts System

Each of the separate prime contractors will be responsible for the completion of his scope of work in accordance with the provisions of his contract. Each of the separate contractors may elect to self-perform all of his work or may award subcontracts for the performance of some of the work in his defined work package.

Separate contracts are now widely used to satisfy a number of owner needs and requirements. Natural division points of the work or subdividing the work into stages or specialty areas can give the owner considerable flexibility in awarding the work for contract. For example, the owner of a building that is to be constructed could decide to award separate contracts for site work; general construction; plumbing; heating, ventilating, and air conditioning; and electrical work. Each of these five contractors, some of whom function as subcontractors on other projects, functions as a prime contractor. Each has a contract with the owner, and each performs independently of the others. Subcontracting by any or all of these five prime contractors is still possible.

Another illustrative example occurs in bridge construction, where separate prime contracts are commonly awarded for the foundations and piers, approach structures, bridge superstructure, bridge deck paving, and painting. Fast-track or phased construction, which is discussed in another section of this chapter, often makes use of multiple separate prime contracts as well.

The use of separate contracts, by breaking the work on the project into smaller packages, can also result in contracts of shorter duration, the obtaining of highly skilled specialty contractors, and better prices through increased competition. One of the principal advantages for the owner stemming from the use of separate contracts is the saving of the markup on work that would otherwise be subcontracted. When the entire work is awarded as a single contract, the general contractor includes in its price a markup on all subcontracted work as a fee for its management and coordination of the subcontractors. Separate contracts can reduce or eliminate this markup altogether. Nevertheless, critics of the multiple-contract approach maintain that, for a number of reasons, the system can increase total construction costs to the owner.

The use of separate contracts can be very troublesome unless carefully prepared contract documents are used and the work is rigorously planned, scheduled, coordinated, and controlled. If strong, centralized management control is not exerted over the separate prime contractors, the several possible advantages of separate contracts will likely turn out to be illusory. The owner, architect-engineer, a coordinating prime contractor, or a construction manager may assume this responsibility, or each contractor may be given the duty by contract of coordinating its work with those of the other primes.

Many courts follow the rule that under separate contracts, the owner is responsible for the overall coordination of the project construction unless the responsibility to coordinate is expressly delegated to another. One approach has been to have all the prime contracts except one include an assignment clause that establishes the remaining prime contractor as the lead contractor or coordinating prime contractor. This party then has the responsibility for project coordination and for proper interface among the remaining prime contractors. The construction manager may also shoulder the coordination responsibility where this form of construction is being used.

In any event, if the party assuming responsibility for overall project direction does not possess the experience and skill required to perform the demanding and specialized management functions needed, separate contracts may become a troublesome procedure indeed. Of particular importance is job delay caused by the inadequate performance of one of the prime contractors. In a separate-contract system, allocation of liability for project delay can become extremely complex, and responsibility may devolve to that party having the duty of overall management control and coordination.

A few states have enacted statutes requiring that designated separate contracts be awarded on state-financed public works. Many other public jurisdictions make the use of separate contracts

optional under administrative authority. The application of separate contracts has proven to be very troublesome at times for some public agencies, causing difficulties with regard to contract award procedures, litigation, and extra construction expense. Experience would seem to indicate that public agencies might advantageously be left free to select a contract system appropriate to project circumstances rather than be restricted by law to a specific procedure.

1.10 FORMS OF CONSTRUCTION CONTRACT AWARD

There are three basic methods by which the contract for construction may be awarded to a construction contractor: competitive bidding, negotiation, and competitive sealed proposals. Within each of these contract award methods, different specific forms of contracts may be utilized, as indicated in Figure 1.7.

1.10.1 Competitive Bid Contracting

Competitive bid contracting has been used historically and continues to be very widely utilized today, for contracts for engineered construction as well as for building construction. Competitive bid contracting has long been the most prevalent form of contract award for construction projects of all kinds. Competitive bidding of public projects is normally required by law and is a formal procedure for public agencies.

In this method of contracting, the owner and the architect-engineer will prepare complete drawings, specifications, and contract documents, which will describe the project in detail and fully define the expectations of the owner in terms of what the contractor is to deliver in performing the project. Bidding documents will also be prepared, which will set forth the procedure by which contractors are

Competitive Bid	Negotiated	Competitive Sealed Proposals
Lump sum	Lump sum	Lump sum
Unit price	Unit price	Unit price
	Cost plus a fixed fee	Cost plus a fixed fee
	Cost plus a percentage of cost	Cost plus a percentage of cost
	Cost plus a fixed fee or percentage of cost, with a guaranteed maximum	Cost plus a fixed fee or percentage of cost, with a guaranteed maximum
	Cost plus a fixed fee or percentage of cost, with a guaranteed maximum and a savings or incentive clause	Cost plus a fixed fee or percentage of cost, with a guaranteed maximum and a savings or incentive clause

Figure 1.7 Project Delivery Methods and Forms of Contracts

made aware of the project and define all of the details and stipulations regarding the bidding and contract award procedures to be used. (Bid documents and contract documents are defined and described in Chapter 4.)

After they have learned of the existence of the contract documents and bid documents, contractors will, if they are interested, obtain a complete set of these documents from the architect-engineer in accordance with the procedures defined in the advertisement for bids or in the invitation to bid. (Advertisements for bids and invitations to bid are also discussed more fully in Chapter 4.) Contractors will examine these documents carefully and then will make a decision as to whether they are interested in proceeding. If not interested, the contractor will return the bid documents and contract documents to the architect-engineer.

If he decides he is interested in proceeding with his effort to secure a contract award for this project, the contractor will embark on the estimating process. As described in Chapter 5, the contractor will prepare a detailed estimate for the project and then prepare a proposal for submittal to the architect-engineer on the designated day, which is referred to as bid day, at the designated time and place.

The contractor will independently prepare his proposal and submit it to the architect-engineer and owner on bid day, in competition with the other contractors who have made a decision to submit a proposal for the project. The architect-engineer will receive all of the proposals from all of the bidding contractors and analyze each proposal as well as the credentials of the contractor who submitted it, and will, along with the owner and within the number of days set forth in the bid documents, decide who the contract recipient will be. The contract is usually awarded to the lowest responsible bidder.

The contractor whose proposal has been accepted will be notified of this fact and notified to meet with the architect-engineer and the owner in order to formalize the contract by signing the agreement. The contractors who were unsuccessful bidders will likewise be notified that their proposals were not accepted and that they will not be receiving the award of the contract.

After the successful contractor has signed the agreement, a letter of intent or notice to proceed will be issued by the designer and the owner to the contractor. This document will authorize the contractor to occupy the owner's site and to commence work on the project, and will denote the beginning of contract time. The contractor will then commence construction operations.

The competitive bid contract award procedure has, as noted earlier, been in use for many years. It offers the advantage for the owner that—if the contract documents fully describe the project and all of the contractor's obligations (and all that the owner will receive) under the contract—the owner will then be the beneficiary of competition among the contractors on the basis of which contractor can deliver the work as defined in the contract documents for the lowest price.

Competitive bidding is used to encourage efficiency and innovation by the participating contractors, thereby providing the owner with a constructed project of specified quality at the lowest possible price. As has been noted, this mode of contractor selection has served its purpose well. However, like other contracting procedures, this method of project delivery does have its weaknesses. To illustrate, the bidding process places the prime contractor and the owner in adversarial positions, which can lead to undesirable side effects. Evidence can be offered to show that competitive bidding can, and sometimes does, lead to the selection of incompetent contractors, excessive claims by the contractor against the owner, disputes and litigation between the two parties, bid shopping, and other problems.

Two different types of competitive bidding are used in the United States: open and closed. The predominant form is open bidding, in which any and all contractors who are interested and can qualify are made aware of the project and encouraged to submit a proposal. All contractors use the same proposal form, which is provided with the bidding documents, with the bids being opened and read

publicly. In each case, the proposal amount is the contractor's final offer, and there is no subsequent bargaining or negotiation. This procedure is sometimes referred to as the *hard-bid* approach.

In closed bidding, a method sometimes employed by private owners, only those contractors who have been preselected by the architect-engineer and owner are invited to submit proposals. There may or may not be a prescribed proposal form, and there may or may not be a public bid opening. The competing contractors may be required to submit their qualifications along with their bids, and may be encouraged to tender suggestions as to how the cost of the work might be reduced through value engineering. The owner selects one of the proposals submitted or perhaps interviews those contractors whose proposals appear most advantageous and negotiates a contract with one of them.

It is interesting to note that the American preoccupation with the low bidder normally being the successful bidder is not shared in many other parts of the world. Some very good arguments can be advanced to show that the lowest bid is not necessarily the best price for the owner, and there are some interesting variations used in other countries. Comparison of competing proposals using the average of the bids received is common. For example, in one European country, the work is awarded to the bidder whose bid is nearest to the average of all bids received. The bid that is greater than but nearest to the average of all bids received, but is still below the owner's estimate, wins the contract in an Asian nation. In another European country, the successful bidder is the one nearest to the average after the highest and lowest bids have been rejected.

Competitive bidding can also be used where the successful contractor is determined on a basis other than the estimated cost of the construction. When the contract involves the payment of a fee to the contractor, the amount of the fee is sometimes used as a basis of competition among contractors. To illustrate, construction management services are sometimes obtained by an owner using the fees proposed by the different bidders as one basis for the contract award.

1.10.1.1 Lump-Sum Competitive Bid Contracting

The lump-sum competitive bid method of contract award has for many years been the most prevalent method of contract award for building construction work. This system is also referred to as *hard-money contracting*.

In this system, the contractor's estimating procedure results in a single lump-sum dollar amount, which represents the exact amount of money for which the contractor is willing to enter a contract to fulfill all of the requirements set forth in the contract documents. Each contractor will independently prepare his estimate for the project and will submit his lump-sum figure on his proposal form on bid day, and will do so in competition with all of the other contractors who are bidding the project. The expectation is that the dollar amount the contractor has entered on his proposal will become the contract amount if the contractor is selected by the owner to be the contract recipient.

Lump-sum competitive bid contracting is possible in building construction work because when the drawings and specifications and other elements of the contract documents completely and accurately describe the expectations of the designer and the owner, the contractors can accurately determine the quantities and prices for all of the materials and equipment to be provided and for all of the work to be performed under the contract. Contractors are able to use their estimating process to arrive at a lump-sum proposal amount for the project. This method of contract award has served owners well for many years, and thus remains in common use today.

1.10.1.2 Unit-Price Competitive Bid Contracting

Unit-price competitive bid contracts are most commonly utilized on highway construction projects, as well as on earthwork cut-and-fill projects such as dams and levees. These types of projects are almost

always designed by an engineer rather than by an architect and, as noted earlier, are often referred to as *engineered projects*.

This contracting method is often utilized by owners because it offers the owner the same advantages inherent in competitive bid contracting, as discussed previously. Additionally, because the types of projects where these contracts are employed are often public projects, laws typically require the use of competitive bid contracts.

Unit prices, that is, dollars per unit of quantity, are used as the basis for contractor selection, and after the contract is formalized, these same unit prices are used as the basis for payments made to the contractor by the owner. The reason for the use of this method is that on the types of projects where the use of these contracts is commonplace, actual quantities of materials and actual quantities of the work to be performed cannot be determined in advance with sufficient accuracy to permit lump-sum estimating and pricing.

On projects of this kind, the design engineers will derive approximate quantities and provide them to the bidding contractors for use in preparing their proposals. When the contract recipient has been selected and the work is performed, the actual quantities necessary to meet project design requirements are measured and verified and then paid for by the owner on a unit-price basis.

In the unit-price system of contract award, the owner and design engineers will typically provide a listing of the major activities, steps, or operations to be performed in the work. With each activity, the engineer provides an estimated approximate quantity of that material or work activity. The owner will require the contractor to enter a unit price, that is, dollars per unit of quantity, that represents the amount of money for each activity that he proposes to complete that activity or work item named on the proposal form in such a way as to satisfy all of the requirements of the contract documents. An example of a typical unit-price proposal form is provided in Figure 1.8.

When the contractor prepares his estimate, he will analyze each activity the owner has named and consult the drawings and specifications and other contract documents for all of the requirements that pertain, and then compute a price for performing that activity or work item. This price will be the sum of the contractor's anticipated costs for materials, labor, equipment, project overhead, general overhead, and his markup. Then the contractor will divide his total estimated cost for each activity by the owner's estimated quantity (or perhaps by his own determination of estimated quantity), in order to calculate the unit price (dollars per unit of quantity), which he will enter on the proposal form. The contractor will use the same procedure for determining the unit price for each of the activities and work items listed on the proposal form.

The contractor will complete his estimate and prepare his proposal, and will submit the proposal, usually in a sealed envelope, on bid day, on the designated date and at the designated time and place, in accordance with the instructions to bidders in the bid documents that he received from the engineer. The engineer will receive all proposals from all of the contractors who are bidding the project at that time.

After all proposals have been received, each will be analyzed by the engineer and the owner, to determine which of the contractors has submitted a valid proposal that will result in the lowest total cost to the owner. That contractor will usually be named the contract recipient.

When the agreement is signed, the unit prices on the contractor's proposal will become the contract prices for the performance of the work in each named activity or work item. As the work on the project is performed, both the contractor and the engineer will tabulate quantities of each named activity or item of work that is actually performed in fulfilling the requirements of the contract documents.

Unit Price Proposal Form

Item Number	Item Description	Estimated Quantity	Unit	Proposed Unit Price	Estimated Amount
1	Excavation, Unclassified	1,667	CY	$3.83	$6,384.61
2	Excavation, Structural	120	CY	$50.72	$6,086.40
3	Backfill, Compacted	340	CY	$17.77	$6,041.80
4	Piling, Steel	2,240	LF	$66.46	$148,870.40
5	Concrete, Footings	120	CY	$195.62	$23,474.40
6	Concrete, Abutments	280	CY	$380.87	$106,643.60
7	Concrete Deck Slab, 10 in.	200	SY	$153.03	$30,606.00
8	Steel, Reinforcing	90,000	LB	$1.045	94,050.00
9	Steel, Structural	65,500	LB	$1.725	$112,987.50
10	Bearing Plates	3,200	LB	$2.49	$7968.00
11	Guardrail	120	LF	$93.59	$11,230.80
12	Paint	1800	SF	Subcontract Item	$12,140.39
		Total Estimated Amount			**$566,483.90**

Figure 1.8 Unit-Price Proposal Form

Prior to each monthly application for payment by the contractor, the engineer and the contractor will review their records regarding actual quantities satisfactorily installed and will reconcile any differences. The engineer will then authorize the owner to make payment to the contractor for the actual quantity of each activity satisfactorily completed, multiplied by the unit price for that activity, less retainage.

This process is continued until the project is complete. It is important to note that the owner will pay, and the contractor will receive, payment for the actual quantity of each activity or work item installed or performed at the contracted-for unit price, without regard to whether this actual quantity is greater than or less than the quantity originally estimated by the engineers during design.

1.10.2 Competitive Negotiation

A form of bidding referred to as competitive negotiation is now sometimes used by the federal government and began with passage of the Competition in Contracting Act of 1984. This act was passed to eliminate the noncompetitive, sole-source contracts that were often being used by some departments and agencies of the federal government. This legislation placed the use of competitive negotiation on the same level as sealed bidding, allowing federal contracting officers to use either method, subject to a few conditions.

Under the competitive negotiation process, prequalified contractors submit priced proposals. The agency then advises each contractor how it can improve its proposal from the standpoint of both design and cost, and new proposals are submitted. Selection is based on price and technical factors. Federal construction awarding sometimes waives open competitive bidding and uses competitive negotiation. National contractor organizations have voiced strenuous objections to the use of this procedure as constituting a threat to the long-established process of open competitive bidding for all public works projects and awarding contracts for public projects to the lowest responsible bidder.

1.10.3 Negotiated Contracting

Construction contracts can also be, and frequently are, formed through negotiation rather than through competitive bidding. While negotiations can take many forms and can be performed in numerous different ways, the underlying concept is that the owner and the prime contractor will negotiate, or bargain for, the terms and provisions of their contract. Whatever the two parties can bargain for and agree upon, absent fraud or any other kind of criminal activity, becomes the contract.

Negotiated contracts are almost never used for public construction projects because the laws that regulate contract formation on these projects require the use of open competitive bidding. On private construction projects of all kinds, however, negotiated contracts are commonly employed.

There are many instances in which it can be advantageous for an owner to negotiate a contract for a project with a preselected contractor or small group of contractors. It is common practice for a private owner to forgo the competitive bidding process entirely and to handpick a contractor on the basis of reputation and overall qualifications, or perhaps based on past experience with that contractor, to perform the project. The forms of negotiated contracts are almost limitless because such agreements can include any provisions mutually agreeable to both parties and best suited to the particular work involved. Most negotiated contracts are of the cost-plus-fee type, which will be discussed in a subsequent section of this chapter.

Extensive use of negotiated contracts has been traditional in some areas of the construction industry such as residential and industrial construction. However, recent years have seen increasing application of negotiated contracts across the board in the private sector. This can only be interpreted as a sign that owners are increasingly finding that such arrangements are in their best interests. A large proportion of the annual work volume of many contractors now consists of negotiated contracts.

1.11 FORMS OF NEGOTIATED CONTRACTS

1.11.1 Lump-Sum

Lump-sum contracts for construction projects can be, and are, negotiated. The contractor and the owner negotiate for the conditions of the contract, and often may include discussions regarding alternate materials for use on the project, on the basis of value engineering. The negotiations culminate in the contractor's providing a lump-sum dollar amount for which he is willing to complete all of the requirements of the contract as negotiated and agreed to.

It is important to note that if a lump-sum negotiated contract is to be agreed to, the owner and the architect-engineer must be able to provide the exact scope of work and the exact specifications for the materials and building systems to be employed, as well as standards for the quality of work to be performed. Only when these conditions are in place can the contractor reasonably be expected to determine a lump-sum amount for performing the requirements of the contract.

1.11.2 Unit Price

The terms of unit-price contracts for construction projects can also be negotiated between the owner and the prime contractor. The parties can negotiate for the conditions of the contract, and can also negotiate the activities or work items to be defined in the work, as well as the unit prices for the performance of each of these work items. This can be especially useful on engineered projects of the kind where exact quantities of the materials required and/or of the work to be performed cannot be determined in advance of construction. Additionally, this method can be useful on restoration, renovation, and remodeling projects, where exact quantities of the several components of the work cannot be determined in advance of performing the work.

1.11.3 Cost-Plus or Cost-Reimbursable

Cost-plus contracts, also known as cost-reimbursable contracts, are very frequently negotiated and are utilized for a variety of construction projects. While they may contain many different provisions and may take a number of different forms, the basic provisions of cost-plus contracts are that the owner will pay or will reimburse the contractor's costs of construction (as defined in the contract), and in addition will pay the contractor an agreed-upon fee or dollar amount for his services.

Cost-plus contracts are commonly employed for any of the following reasons:

1. When the work to be done does not lend itself well to the preparation of complete drawings and specifications in advance of construction.
2. When the exact scope of work is unknown at the time construction commences.
3. When the nature of the work does not lend itself to exact quantity determinations and/or price determinations before construction is to get under way.
4. When speed in commencing construction is an objective.
5. When one of the objectives is to remove or minimize risk in the project for the contractor, thereby making the project more attractive and/or resulting in a better price for the owner.

When cost-plus contracts are negotiated, there are several considerations that should always be included as part of the negotiation and contract formation. Among these are the following:

1. Mutual understanding and firm definition of costs which are to be reimbursable to the contractor, and costs which are nonreimbursable.
2. Whose accounting person or department will be utilized for project accounting.
3. Generally, an "open books" accounting method is employed, whereby all accounting documents for the project are available and transparent to both the owner and the contractor.
4. Regular audits of the contractor's payroll records and/or materials invoices on the part of the owner.
5. Clear understanding must be derived regarding contractor's general overhead and project overhead costs allocated to this particular project.
6. The subcontract award and subcontract payment procedures to be employed.
7. Responsibility for errors in the work and for rework.
8. Provisions regarding the requisite quality in the workmanship, and for rejection of nonconforming work.
9. When the contractor's fees are payable
10. Warranty provisions.

1.12 BASIC ELEMENTS OF AGREEMENT IN THE VARIOUS TYPES OF COST-PLUS CONTRACTS

1.12.1 Cost Plus a Fixed Fee

The owner will reimburse the contractor's costs of constructing the project, as the costs have been defined and agreed upon, as discussed in the previous paragraphs. Over and above those costs, the owner will pay the contractor an agreed-upon lump-sum fee.

In order for this variation of cost-plus to be workable for the contractor, a relatively firm definition of scope of work is required. A significant drawback of this contract form that is often troublesome for owners and for the financial institutions that provide construction financing and permanent financing for the project is the fact that the contract form places no upper limit on what the total cost of construction will be. This form of contract is referred to as an *open-end contract*.

1.12.2 Cost Plus a Percentage of Cost

The owner will reimburse the contractor's costs of construction and, in addition, will pay a negotiated agreed-upon percentage of all of the defined project costs to the contractor as his fee for performing the work on the project.

This form of contract is very useful when the scope of work cannot be accurately defined in advance or when the intent is to get the work under way at the soonest possible time without awaiting complete definition and determination of scope of work. Additionally, this form of cost-plus contract is commonly used on engineered projects where the actual quantities of the work to be performed or the materials or systems to be installed cannot be accurately quantified in advance. This contract form is also very widely used in restoration, renovation, remodeling, and adaptive reuse building projects where the variables that will be encountered in the performance of the work cannot be defined and predicted in advance. Cost plus a percentage of cost is also a form of open-end contract.

1.12.3 Cost Plus a Fixed Fee or Percentage of Cost, with a Guaranteed Maximum

The owner will reimburse the contractor's costs of construction, and over and above those costs will pay either an agreed-upon lump-sum fee or an agreed-upon percentage of those costs to the contractor as his fee for performing the work on the project. The contract also contains an additional provision for a guaranteed maximum on the part of the contractor. This means that the contractor guarantees to the owner that the total cost of the construction project will not exceed the guaranteed maximum amount.

If the contractor's costs for performing the agreed-upon scope of work to the agreed-upon level of quality exceeds the guaranteed maximum amount, he still must complete the project and must fulfill all of the requirements set forth in the contract documents. However, the contractor will pay for all additional costs beyond the guaranteed maximum amount, thereby avoiding the difficulties associated with open-end contracts. Complete definition of the scope of work, as well as specific definition of quality of materials and workmanship to be provided, are required.

The contractor is in a risk-taking position, and the owner has a guarantee of the upper limit of the cost of construction. Sometimes the point has been offered, however, that there is little incentive for the contractor to complete the work at a price less than the guaranteed maximum.

1.12.4 Cost Plus a Fixed Fee or Percentage of Cost, with a Guaranteed Maximum and a Savings or Incentive Clause

The owner will reimburse the contractor's costs of construction, and over and above those costs will pay either an agreed-upon lump-sum fee or an agreed-upon percentage of those costs to the contractor as his fee for performing the work on the project. Additionally, a guaranteed maximum amount is negotiated by the owner and the contractor, so that the contractor must complete the work to satisfy contract requirements for an amount not greater than the guaranteed maximum amount. If the contractor cannot complete the project for the guaranteed maximum amount or less, he still must complete the defined work and must fulfill all contract requirements; however, all additional costs to complete, beyond the guaranteed maximum amount, must be borne by the contractor. Again, for the owner, the maximum amount that he could pay for the completed construction project is defined by the guaranteed maximum amount in the contract.

In addition, in this form of contract, the contractor and the owner will negotiate a number, called a target figure, also referred to as an upset figure, which is equal to or less than the agreed-upon guaranteed maximum amount. The owner and the contractor agree (and write into the contract) that for each dollar less than the target figure for which the contractor can satisfactorily complete all of the requirements of the contract, there will be some split of those dollars between the owner and the contractor. The amount of the split payable to the owner and to the contractor is negotiated and agreed upon and is written into the contract.

There are advantages as well as disadvantages for the parties to the contract associated with each of these variations of cost-plus contracts. A basic summary of these considerations is provided in Figure 1.9.

1.13 COMPETITIVE SEALED PROPOSALS

Competitive sealed proposals is a relatively new method of contract award that is widely used today and is growing in popularity. When this method is used, the owner invites contractors to prepare proposals for a project for the owner. Each contractor will independently prepare a proposal, in accord

Variations in Forms of Cost-Plus Contracts, and Advantages and Disadvantages Inherent in Each Form

	Advantages	Disadvantages
Cost Plus a Fixed Fee	Some flexibility for the owner to make changes.	Open-ended contract for owner. Owner does not know what the final cost of the construction will be, nor what the maximum cost of the construction will be.
	Some flexibility for the contractor to accomodate changes by the owner.	Open-ended contract form is very troublesome for lenders who provide construction and permanent financing for construction projects.
		Open-ended contracts are also very troublesome for those who provide insurance and bonds for construction projects.
		Since his fee is predetermined and is written into the contract, the contractor will require relatively firm definition regarding the scope and duration of the work, as well as the quality of materials and workmanship to be provided.
Cost Plus a Percentage of Cost	Maximum flexibility for the owner to make changes in the work, including making changes in the scope of the work.	Open-ended contract for the owner. No definition of what the final cost of the project will be.
	Maximum flexibility for the contractor in accommodating changes made by the owner.	Open-ended contract form is very troublesome for lenders who provide construction and permanent financing for construction projects.
	Minimum risk for the contractor.	Open-ended contracts are also very troublesome for those who provide insurance and bonds for construction projects.
		No incentive, at least by the terms of the contract, for the contractor to be efficient, or effective, or cost-conscious.
Cost Plus a Fixed Fee or Percentage, with a Guaranteed Maximum	Provides definition for the owner, and for those financing the project, for what the maximum cost of the project will be.	Requires the owner to provide firm definition of project scope and duration. Owner also must provide complete definition of materials quality and standards of workmanship in the form of specifications.
		Places the contractor at risk for completing the project requirements for a sum not to exceed the guaranteed maximum amount.
		No reward for the contractor, if he exercises his skill and good judgment, and thereby completes the project for significantly less than the guaranteed maximum amount.
		Requires the owner to provide firm definition of project scope and duration, as well as for quality levels of materials and workmanship to be provided.
Cost Plus a Fixed Fee or Percentage, with a Guaranteed Maximum and a Savings or Incentive Clause	Provides definition for the owner, and for those financing and bonding the project, for what the maximum cost of the project will be.	Places the contractor at risk for completing the project requirements for a sum not to exceed the guaranteed maximum amount.
	Provides an incentive for the contractor to complete the project with maximum efficiency and cost consciousness, while satisfying scope and quality requirements as established by the owner.	Requires the owner to provide firm definition of project scope and duration, as well as for quality levels of materials and workmanship to be provided.
	Provides the owner an opportunity to share in the savings resulting from the contractor's efficiencies.	

Figure 1.9 Advantages and Disadvantages of Different Cost-Plus Contracts

with instructions and guidelines that the owner has provided, and will submit that proposal to the owner at the time specified by the owner.

These proposals may include construction services, construction management services, or design-build services. They may include value engineering of a design that the owner has furnished. These competitive sealed proposals also commonly include the contractor's proposed time schedule for the performance of the work. The price that the contractor submits in his proposal may be a lump sum, or a series of unit prices, or it may be one of the variations of cost-plus.

In addition to describing the professional services that the contractor will provide, the competitive sealed proposal will also contain a great deal of additional information about the contractor: his background and experience, his portfolio of projects completed, and the history of owners he has contracted with and performed work for, along with those owners' contact information. The credentials of the contractor's estimating and scheduling and project management personnel, and his supervisory personnel, will typically be provided, often including the resume's of the project manager and the superintendent or foremen who will manage the owner's project.

The contractor will typically be required to submit information regarding his safety policies, as well as his accident history, and his experience modifier rating (EMR). Additionally, the owner will usually request a copy of the contractor's quality assurance policy or his total quality management (TQM) program.

The owner also commonly requires the prime contractor to include in his submittal the names and credentials of the major subcontractors whom he will plan to utilize on the project. Lists of projects completed, including projects of the size and type the owner envisions, are commonly required relative to the key subcontractors. Additionally, lists of references from owners, general contractors, construction managers, and others usually must be furnished, as well as copies of the subcontractors' written quality management and quality assurance programs. Usually, the subcontractors' key management and craft labor personnel and their credentials must be provided, including the names and qualifications of the subcontractors' project manager and supervisor who will be assigned to this project. This allows the owner to evaluate each subcontractor before the project is awarded, including their financial capability as well as their ability to satisfactorily perform a project of the size and type the owner is planning to construct.

The owner will receive this comprehensive package of information in the form of competitive sealed proposals from each of the contractors whom he has invited to submit on the project. The owner, frequently with the assistance of an architect-engineer or construction manager, will review each competitive sealed proposal in detail, in order to determine who the contract recipient will be, who will be selected to enter a contract to perform the owner's project. Sometimes a point system is established by the owner in order to provide the owner a means of quantitatively assessing various components of each contractor's submittal.

Sometimes the owner will make a preliminary assessment of all of the submittals and then will invite some of the contractors who have received good evaluations on their submittals, and who are now finalists to receive the contract award, to prepare verbal presentations for the owner and his design team or management staff and to answer questions and clarify issues presented by the owner and the architect-engineer. At the conclusion of this process, the owner will make the selection of the contract recipient who will perform his project.

The intent of competitive sealed proposals is to provide the owner with a great deal of information with regard to each of the contractors who is submitting a proposal, in advance of selecting the contract recipient. The intent of the owner and architect-engineer and/or construction manager gathering this information is to assist them in making the best choice regarding the contract recipient. For their part,

contractors are afforded the opportunity not only to provide their price, but also to furnish information regarding their experience and their qualifications. Additionally, this method of contract award allows contractors to input their expertise regarding materials and systems for use in the project.

1.14 OTHER FORMS OF CONTRACTS

1.14.1 Time and Materials Contracts

Owners and contractors sometimes enter contractual arrangements wherein construction work is to be done on a "time and materials" basis. These arrangements are essentially the same as cost-plus contracts.

The owner agrees to reimburse the contractor for the cost of materials and, beyond those costs, agrees to pay the contractor an agreed-upon number of dollars per hour, per day, per week, per month, and so on for his work. The dollars per unit of time agreed upon will compensate the contractor for his labor costs, as well as his equipment costs and his overhead costs, and will include his markup.

1.14.2 Job Order Contracting

This contracting arrangement is often used for building maintenance or for facilities management contracts but is applicable to other forms of construction work as well. In this contract form, the owner will compile a list or a schedule of operations or items of work that he has need for, or that he anticipates he may have need for, during a defined period of time, such as one year. The description of each item of work will include a complete scope-of-work definition, as well as specifications regarding the level of quality of materials and workmanship to be provided in performing this work package.

The owner will then enter an agreement with a contractor, often after receiving proposals or price quotations from several different contractors, on a dollar figure for the performance of each work package, in compliance with the specifications. Response times and durations of work for each of the activities are also typically included in the agreement.

Subsequently, when the owner finds himself in need of one of the services described in the job order contract, he will contact the contractor, who will then respond and will perform the work as described and specified. Following completion of the work, the contractor invoices the owner for the work at the agreed-upon rate, and the owner makes payment to the contractor.

1.14.3 Construction by Force Account

Force account, also known as doing work by day labor, is another instance where the owner acts as the prime contractor. In this case, the project is normally constructed for the owner's own use. Under this method, owner-builders may choose to perform the work with their own forces, providing the necessary field supervision, materials, construction equipment, and labor.

Alternately, owners may choose to have the work for their facility performed entirely by subcontract, subletting individual segments of the work to specialty contractors. In such a case, owners assume the responsibility of coordinating, managing, and directing the work of the subcontractors.

Many studies have been performed, mostly by public agencies, to compare the costs of construction accomplished by competitive bidding and by force account. These studies have clearly demonstrated that for all but very small projects, the force-account procedure is generally more expensive than the competitive bid method. In addition, it has been demonstrated that the quality of the work is usually better when it is performed by a professional contractor.

There are several good reasons why contract construction is usually cheaper and better than that done by force-account means. A qualified prime contractor has a wide background of experience and is intimately familiar with materials, construction equipment, and field methods. The contractor maintains a force of competent supervisors and workers, and is adequately equipped to perform the work. Construction is a specialized business, and a contractor must be proficient in the work in order to survive. All these factors lead to efficiencies of cost and time that owners find difficult to match unless their own organizations already include trained and experienced construction forces.

In the usual instance, public construction is contracted on a competitive bid basis as required by policy or law. However, there is a continuing issue of government at all levels—federal, state, and local—performing some of its own construction work and being in competition with the private sector. Even though day labor construction by a public agency is ordinarily limited to maintenance, repair, small jobs, and emergencies, there are still many cases of public agencies performing substantial amounts of construction with their own forces. The construction industry has attempted to minimize such government competition with the private sector by seeking legislation to require public owners to make their work available to the professionals in the construction community.

It must be noted at this point that the term *force account* is sometimes used in a different context than that just described. While a contractor is proceeding with work under contract, it is not unusual for the owner to find it necessary to modify or add to the work. Additional payment to the contractor in such an instance is often established on the basis of a lump sum or unit prices. There are times, however, when the contractor is authorized to proceed on some type of a cost-plus or time and material arrangement. This is sometimes referred to as proceeding with the extra work on a force-account basis.

1.15 SMALL AND DISADVANTAGED BUSINESS ENTERPRISES

For a number of years, federal, state, and local governments have applied various forms of construction procurement to assist economically and socially disadvantaged contractors. Such programs have been devised by public agencies to assist small businesses, minority business enterprises, and businesses owned by women in obtaining a larger share of public works construction contracts. Such actions are directed toward establishing various forms of bidding advantages for small and disadvantaged contractors. One procedure in this regard is the use of "set-asides" where certain public construction contracts are designated as being available only to such businesses. Various forms of goals have been established, assisted by imposed quotas and bid penalties applied to nonqualified contractors. Another method has been to require prime contractors bidding on designated public contracts to subcontract at least a designated percentage of their work to small businesses or disadvantaged contractors.

Despite some controversy and problems with such public programs, however, there is no doubt that they have made it easier for small and disadvantaged firms to establish and conduct active and viable construction businesses. In so doing, public agencies have clearly increased the business opportunities for such contractors. The National Association of Minority Contractors (NAMC) has rendered valuable assistance in helping minority contractors make the necessary contacts and to meet established certification requirements for set-aside projects. Experience with such construction programs has enabled public agencies to substantially improve the rules and administration of such procurement procedures and to establish better certification rules and criteria for the prequalification of small and disadvantaged businesses.

1.16 SEASONALITY IN CONSTRUCTION

The volume of construction that is in progress in this country at any point in time varies with a number of factors, with a major factor being the season of the year when the survey is taken. Although seasonal fluctuation varies with the geographic location and type of construction activity, on a national basis summer is the peak season and winter is a much slower period for almost all segments of the construction industry.

The reason construction is such a seasonal business is primarily the effects that inclement weather and low temperatures have on certain key construction operations. An undesirable result of this uneven work volume is serious shortages of skilled workers during the warm weather months and extensive unemployment during the winter. Work does not stop during the winter months, of course, but frequently there are layoffs, reductions in crew sizes, fewer project starts, and weather delays, which result in significant reductions in the construction workforce.

To illustrate this point, studies have shown that total construction employment in this country during a typical year varies approximately 25 percent from the summer to the winter months. It must also be realized that, like total employment, average weekly hours worked follow a seasonal pattern in the construction industry. Overtime work is common during the summer months, while less than full workweeks are frequent during the winter.

Seasonality in construction is a serious national problem, resulting in inefficiency, increased costs of production, and the wasteful misuse of valuable skilled labor. Peak-season bottlenecks and the resulting inflationary pressures have led to public concern. Several government groups have studied the problem and have recommended actions to provide fuller utilization of construction labor. Recommendations have included the more effective use of science and technology, improved scheduling of public contracts, and the relation of national manpower policy to the stabilization of construction employment. Private action has also been encouraged to better regularize the employment of construction workers throughout the year. Many foreign countries with severe winter climates have been forced to find ways to lengthen their construction seasons. This has been accomplished by a variety of public policies involving licensing, resource allocation, loans, and the payment of government subsidies of one type or another to encourage winter work.

1.17 LICENSING

Because construction can affect the public interest, there are special laws pertaining to construction that are designed to protect the public health and safety. These requirements include building codes, zoning regulations, environmental regulations, building permits, field inspections, safety and health regulations, and the licensing of contractors and skilled workers in certain construction crafts. It is to be noted at this point that the discussion of licensing in this section is concerned only with the licensing of a construction contractor per se by a contractors' license board. This matter as discussed here is separate and apart from a requirement for a corporate license to do business as a corporation in a given state and is also separate from an occupational license granted by a country or by a county or city government.

The licensing of contractors is not universally required, but many states and local governments do require that some or all contractors doing business within their jurisdictions be licensed. Some of the licensing statutes or ordinances are solely revenue-raising measures. Under these particular laws, the payment of a license fee confers the right to conduct a construction business, with no further conditions having to be met. Generally, however, the statutes provide that the contractor must not

only pay a fee but also must meet certain minimum qualifications. These statutes establish a board of registration or other regulatory body that administers the law, accepts applications for licensing, gives examinations where required, issues the licenses, collects the fees, and generally enforces the provisions of the licensing law.

Licensing requirements vary widely among those areas that have such laws. In most cases, however, when the law requires a license, it applies equally to general construction and specialty contractors, even when the specialty work is subcontracted. Most of these laws require licenses only for contractors whose annual volume of business exceeds certain designated amounts. Almost all statutes of this kind require that a license be obtained in advance of any bidding within the state, with certain minor statutory exemptions. Some areas exclude from licensing those contractors doing work financed by federal funds or performed for the federal government on government-owned land.

Certain jurisdictions issue various classes of licenses, differentiated in accordance with maximum size of contract or annual volume of business. In addition, licenses may be issued that are valid for, and apply only to, specific construction types such as general engineering construction, general building construction, or any of several classifications of specialty work. In a number of cases, contractors must pass an examination before the license is issued.

It is very important that a contractor be properly licensed where this is a legal requirement of the area in which the work is to be performed. Most licensing laws provide that acting or offering to act in the capacity of a contractor without a valid license is a misdemeanor criminal offense. Also important to note is the fact that a contractor who is not licensed at the time it contracts to perform construction services may not sue to collect for work that has been performed or for breach of contract. Contracts executed by unlicensed contractors are normally void as a matter of law, and such contracts cannot be enforced in court or in arbitration. In addition, the unlicensed contractor may have no right to file or claim a mechanic's lien against the owner's property.

With regard to licensing, where it is required, it is important to note that the construction company must be licensed in the form in which it contracts or offers to contract. For example, if a licensed partnership changes to a corporation, most licensing laws provide that the partnership license is not applicable and that the corporation must be licensed as such. Additionally, the law in some areas makes it unlawful for a joint venture to act as a contractor without being licensed as such, even though each member of the joint venture is individually licensed. There are now some states that require that any party providing construction management services in those states must possess a valid state contractor's license.

In addition, it should be noted that many political jurisdictions require the licensing, registration, or certification of workers in certain crafts. Plumbers and pipefitters, electricians, welders, riggers, elevator installers, sprinkler fitters, and hoisting machine operators are illustrative examples. Required qualifications differ somewhat in various geographical areas and jurisdictions.

1.18 LICENSE BONDS

A few states and many local governments require that all licensed contractors, including subcontractors, who operate within their jurisdictions post permanent surety bonds with the appropriate government authority. These are in the nature of performance and payment bonds, a subject discussed more completely in Chapter 7. Such bond requirements are intended to serve for the protection of the public. The public authority or other party may bring process against such a bond in the event of unpaid debt or malfeasance on the part of the contracting firm. The bond also serves to guarantee that the contractor will make proper payment for required permits and inspections.

It is a somewhat more common practice to require bonds of only certain contractors whose work is closely associated with public health and safety. The following is a representative listing of specialty contractors who are typically required to furnish license bonds:

- Boiler installation
- Curb, gutter, and sidewalk (on public property)
- Demolition
- Electrical
- Elevator installation
- Gas fitting
- House moving
- Plumbing
- Sign erection

In many areas, firms proposing to do such work must first post the requisite bond in the required amount with the designated public authority before commencing operations.

1.19 BUILDING CODES

Building codes have been adopted by numerous states and municipalities in the United States. A building code can be defined as a minimum set of requirements for building design and construction, adopted into law by some state governments and by many municipal governments, whose stated purpose is "to provide for the safety, health, and welfare of the public."

Passed into law to protect the public health and safety, these statutory building codes establish rules and standards that control the design, materials, and methods of construction, as well as certain aspects of the design and construction processes themselves, and compliance with them within their jurisdiction is mandatory. These codes typically apply to the construction, alteration, repair, demolition, and removal of new and existing buildings, including service equipment in buildings.

Most of these city and state code statutes are based, in whole or in part, on one of four model building codes that have been authored by and are sponsored and administered by parent organizations, whom we will refer to as authoring and administering agencies. These authoring and administering agencies consist of assemblages of experts in a variety of fields associated with building design and construction. These experts organized themselves into a corporate structure and addressed the task of producing design and construction standards that would provide for the safety, health, and welfare of the public. The written work they produced was given a name and was published and made available to governments who might wish to use them. These documents are called model codes. These model code documents have no authority or power of enforcement on their own accord. However, when state or city governments adopt a building code statute, they typically adopt one of the model code documents as the basis for their code statute.

In addition, there are some building codes of law that are not based on model codes but have been specifically written for a particular locality. Chicago, San Francisco, and several other large cities in the United States are of this type.

Additionally, there are special-purpose codes, such as those now adopted by several states, that pertain to prefabricated housing. These state laws regulate operations of housing manufacturers within

the state and set standards for such housing coming into the state from other manufacturers. Mobile home manufacturing is currently regulated by a preemptive federal code.

Generally, when city or state governments have adopted one of the model codes as the basis for their code statute, they have also decided to adopt provisions that pertain to their local needs and conditions and/or to make their requirements more stringent than those set forth in the model code document. These changes are typically adopted into law as amendments to the model code document, and they may add to, delete from, or make changes to the model code document.

Various boards, commissions, building departments, and other public bodies administer and enforce the provisions of their code statutes. The four model building codes mentioned in the preceding paragraph are listed below. These model codes and their authoring and administering agencies are frequently referenced by their names and/or the acronyms for their names.

1. *National/Basic Building Code (NBC)*. Published by Building Officials and Code Administrators International, Inc. (BOCA).
2. *Uniform Building Code (UBC)*. Published by the International Conference of Building Officials Inc. (ICBO).
3. *Standard Building Code (SBC)*. Published by the Southern Building Code Congress International Inc. (SBCCI).
4. *International Building Code (IBC)*. Published by the International Code Congress Inc. (ICC). The IBC bears special mention, inasmuch as it is frequently referred to as a "consensus code."

   First published in 2000, it is authored and administered by the ICC. This body in turn is composed of representatives from the other three model code authoring and administering agencies, BOCA, ICBO, and SBCCI. For this reason, the International Building Code is sometimes referred to as a "consensus code."

   The IBC was written and published in response to the difficulty experienced by owners, architect-engineers, contractors and subcontractors, materials suppliers, building code lawmaking bodies, and code administration and enforcement officials, whereby three different model codes, any of which might be adopted as the code of law by any state or city government, imposed a hardship on the building construction profession.

   The IBC was intended to provide a single model code that would contain the best features of the other three operative model codes. While in many ways the IBC has accomplished this purpose, the problem of multiplicity of code requirements remains, because almost invariably when city or state governments have adopted the IBC as the basis for their code of law, they have also adopted locally written amendments to customize the code requirements to the needs of their local constituency.

These four codes are the basic documents produced by their respective authoring and administering organizations. It should be recognized that each of these model codes is accompanied, or in many cases includes by reference, a variety of standards, subcodes, and other code documents. These standards and other codes address requirements for such specialty items as electrical work, plumbing, fire prevention and safety, mechanical work, solar energy, swimming pools, elevators, and others. Examples of some of these other codes and subcodes are:

- National Plumbing Code, published by the American Public Health Association and the American Society of Mechanical Engineers.
- National Electrical Code, published by the National Fire Protection Association.

- Life Safety Code, published by the National Fire Protection Association.
- International Plumbing Code, International Electrical Code, International Residential Code, International Energy Conservation Council (ICC).

To ensure that applicable codes are adhered to within their statutory jurisdiction, cities that have adopted building code statutes normally require various forms of design reviews, building permits, field inspections at certain stages of construction, and test reports. A general building permit is an almost universal requisite, requiring the filing of complete drawings and specifications prepared by a registered architect-engineer with a designated public building official's office. These documents are reviewed for design conformance with the applicable codes by the responsible building authority before a building permit is issued. Permits for plumbing, electrical work, heating and air conditioning equipment, elevators and escalators, and refrigeration systems are also normally required. In addition, occupancy permits or certificates of occupancy are usually established after the completion of a building, requiring a final inspection to ensure compliance with building code standards.

The form and content of building codes vary widely from one political jurisdiction to another, with the several states and cities varying with regard to their code statutes. Considerable variance exists with reference to code provisions and coverage, job inspection, enforcement, and appeal procedures. Such code diversity has frequently been criticized as inhibiting the use of construction mass-production techniques and the introduction of new materials, systems, and procedures. Difficulties faced by design and construction firms who work over wide areas are cited, in conjunction with pleas for a uniform national code. Similar problems are faced by building material manufacturers who market their products on a national scale. Code diversity is defended as being necessary to make adequate provision for local conditions such as climate, winds, hurricanes and other storms, and earthquake hazards. It can be predicted with certainty, however, that as long as building regulations and building codes remain police powers to be determined by state and local government, any appreciable degree of building code uniformity on a national scale is not likely to take place.

Conformity with the applicable building code is first the responsibility of the design professional, who bears a duty to produce a design that will be compliant with the building code where the building will be constructed. The contractor undertakes to construct in accordance with contract documents and must simultaneously comply with building code requirements. Typically, the contractor is required to notify the city or state government building official at specified intervals during the construction process, in order to allow for inspections of that phase of the construction. Passing the inspection indicates the approval by the building authority of that increment of the construction, and serves as authorization for the contractor to proceed to the next phase of the construction. It is typically the duty of the contractor to be knowledgeable of the building code provisions and to obtain the necessary permits for construction and schedule the requisite inspections during construction.

1.20 CONTRACTOR ORGANIZATIONS

A large number of trade, technical, and professional organizations serve the diverse interests of the construction industry. These associations represent the design professionals, general and specialty contractors, homebuilders, manufacturers and distributors of building materials and construction equipment, insurance and surety companies, financial interests, and others.

There are many associations of contractors throughout the country. Among the national associations that represent general contractors, the senior organization is the Associated General Contractors of America (AGC), whose membership includes building, heavy, highway, and utility contractors.

The Associated Builders and Contractors (ABC) is made up of member contractors who operate open shops, also referred to as merit shops. The National Association of Home Builders (NAHB) is a national professional organization representing all aspects the housing industry. Many highway and heavy contractors belong to the American Road and Transportation Builders Association (ARTBA).

Both local and national specialty contractor organizations also function to promote the mutual benefit of their members and to bring their combined resources to bear on common problems. The American Subcontractors Association (ASA), the National Electrical Contractors Association (NECA), the Mechanical Contractors Association of America (MCA), the Sheet Metal and Air Conditioning Contractors National Association (SMACNA), the Association of Plumbing and Heating Contractors (APHC), the National Utility Contractors Association (NUCA), the Mason Contractors Association of America (MCAA), and the National Roofing Contractors Association (NRCA) are among the oldest and most prominent.

These associations usually parallel the craft jurisdictions of the building trades and are represented by aggregations of specialty contractors such as electrical, mechanical, utility, masonry, or roofing contractors. Other National organizations also exist such as the Associated Specialty Contractors which is an umbrella organization of nine national associations of construction specialty contractors, whose combined membership totals more than 25,000 firms. This organization is a coalition of eight national associations of construction specialty contractors that represents subcontractors in all segments of the building construction industry and concentrates on business, contract, and payment issues affecting all subcontractors.

These associations perform a number of invaluable professional services for their members, such as monitoring federal and local and legislation and providing lobbying efforts, providing standard forms of construction documents of all kinds, sponsoring safety and apprenticeship programs, assisting with or conducting labor negotiations, providing tax information, holding conferences, promoting public relations, and serving as clearinghouses for construction information of all kinds. These organizations strive to maintain the business and ethical standards of contracting at a high level and to establish the integrity and responsibility of their members in the public mind.

1.21 MANAGEMENT PRACTICES IN CONSTRUCTION

On the whole, it can be said that construction contractors have been slower than some other businessmen in applying proven management methods to the conduct of their businesses. A number of analysts and consultants have characterized management in the construction industry as being weak, inefficient, and slow to react to changing conditions. These generalizations regarding the industry do not mean that all construction companies are poorly managed. To the contrary, some of America's best-managed businesses are construction firms, and it may be noted with satisfaction that the list of profitable construction companies is a very long one indeed. One need only look at compilations such as the Engineering News-Record annual listing of the top 500 contractors in the United States, to see that many construction companies are flourishing and successfully performing huge volumes of work. Nevertheless, in the overall picture, the construction industry is at or near the top in the annual rate of business failures and resulting liabilities.

There are several explanations frequently provided in an effort to explain why the construction industry has been slow in applying management procedures that have proven effective in other industries. Construction projects are unique in character and do not lend themselves to standardization. Construction operations involve many skills, and are largely nonrepetitive in nature. Projects are constructed under local conditions of weather, location, transportation, and labor, which frequently

present variables that are beyond the contractor's control. The construction business is volatile, with many seasonal and cyclical increases and decreases in volume of work. Additionally, despite all of the impressive size of some of the largest firms, the greatest number of construction firms are small operations, where the management decisions are made by one or two persons.

The conclusion cannot be drawn, however, that management problems in the construction industry are uniquely different from those in other industries. The complexity of the product and the lack of production standardization do indeed lead to difficult management problems, but those in construction are not necessarily more complicated than those in other business fields. Many other industries are characterized by a large number of relatively small firms. There are numerous areas of businesses that experience wide seasonal or cyclical variations in the demand for their products and services. Construction is certainly not the only industry that experiences keen competition. Ineffective management in construction is not, therefore, the inevitable result of pressures and demands peculiar to the construction industry. As a matter of fact, the presence of such pressures and demands underscores the need for astute and effective management in the construction industry.

It is an inescapable principle that skilled management and business survival and success are accompaniments to one another. The fact that this maxim has not been recognized by all construction firms is amply demonstrated by the high incidence of financial failures in the construction industry.

1.22 BUSINESS FAILURES IN CONSTRUCTION

Construction contracting is one of the riskiest of all business types, and every year many contracting concerns fail for a variety of reasons, causing millions of dollars in losses. The construction contracting business has one of the highest failure rates of any business in the United States. Although companies of all sizes, old and new, fail each year, statistics show that the most likely firms to fail are those that are small in size and limited in experience.

A number of studies have been conducted and the results published by Dunn and Bradstreet and by a number of others, seeking to identify the reasons and combinations of reasons why construction companies fail. The most common reasons cited are the following, which are not rank-ordered:

- Lack of business knowledge.
- Lack of managerial experience.
- Poor accounting system.
- Insufficient capital.
- Inability to be competitive, especially when doing work in a new region.
- Heavy operating expenses.
- Lack of early warning measures.
- High employee turnover.
- General economic conditions.

Consideration of these factors makes it clear that the financial success and the survival of a construction enterprise depends almost entirely on the quality of its management. Many outward manifestations of these root causes are often cited for business failure: seasonal business variations, weather hazards, job delays, inadequate sales, competitive weaknesses, low profit margins, cash flow difficulties of all kinds, and overextension. It follows, however, that these business inadequacies are simply indicative of poor business management.

1.23 SUMMARY AND CONCLUSIONS

The construction industry is a complicated industry to understand because it is such a large industry and because of its numerous different characteristics, which exist in many variables and sets and subsets. Additionally, the industry contains many variations and defining terminologies. Certainly, it is a business that is fraught with risk and uncertainty. However, for those who make themselves well informed so as to understand the characteristics and workings of the industry, and who avail themselves of the principle that knowledge and proper management are the keys to success, the construction contracting business can be highly rewarding, in terms of both profitability and the unparalleled sense of personal accomplishment that successful practice in the industry can bring.

CHAPTER 1 REVIEW QUESTIONS

1. Define and describe privity of contract. On a typical construction project, name three people with whom the prime contractor has privity of contract.

2. Can a construction firm that is a subcontractor on one construction project simultaneously be a prime contractor on another project? Explain.

3. Define the term *construction manager,* and discuss the origin of the concept.

4. Name three of the most common reasons for construction company business failures as defined in this chapter.

5. List and define each of the bid documents that are typically prepared for a project.

6. Provide the names and acronyms for four national contractor professional associations.

7. Define the term *open-end contract,* and name two forms of contract defined in this chapter that are open-end forms of contract.

8. Why are unit-price contracts employed most prevalently on engineered and heavy construction projects?

9. Define fast-track construction, and provide a synonym. Describe the primary objective of fast-track, and the primary risk factors that are inherent in this project delivery method.

10. Define the competitive sealed proposals method of contract award, and explain the advantages it offers.

11. Define building codes, and name the four primary national model codes.

12. Define job order contracting.

13. Name and define the two types of financing that the owner arranges for a construction project. Provide a synonym for each term.

14. Define value engineering.

15. Define and describe construction management agency with construction manager at risk.