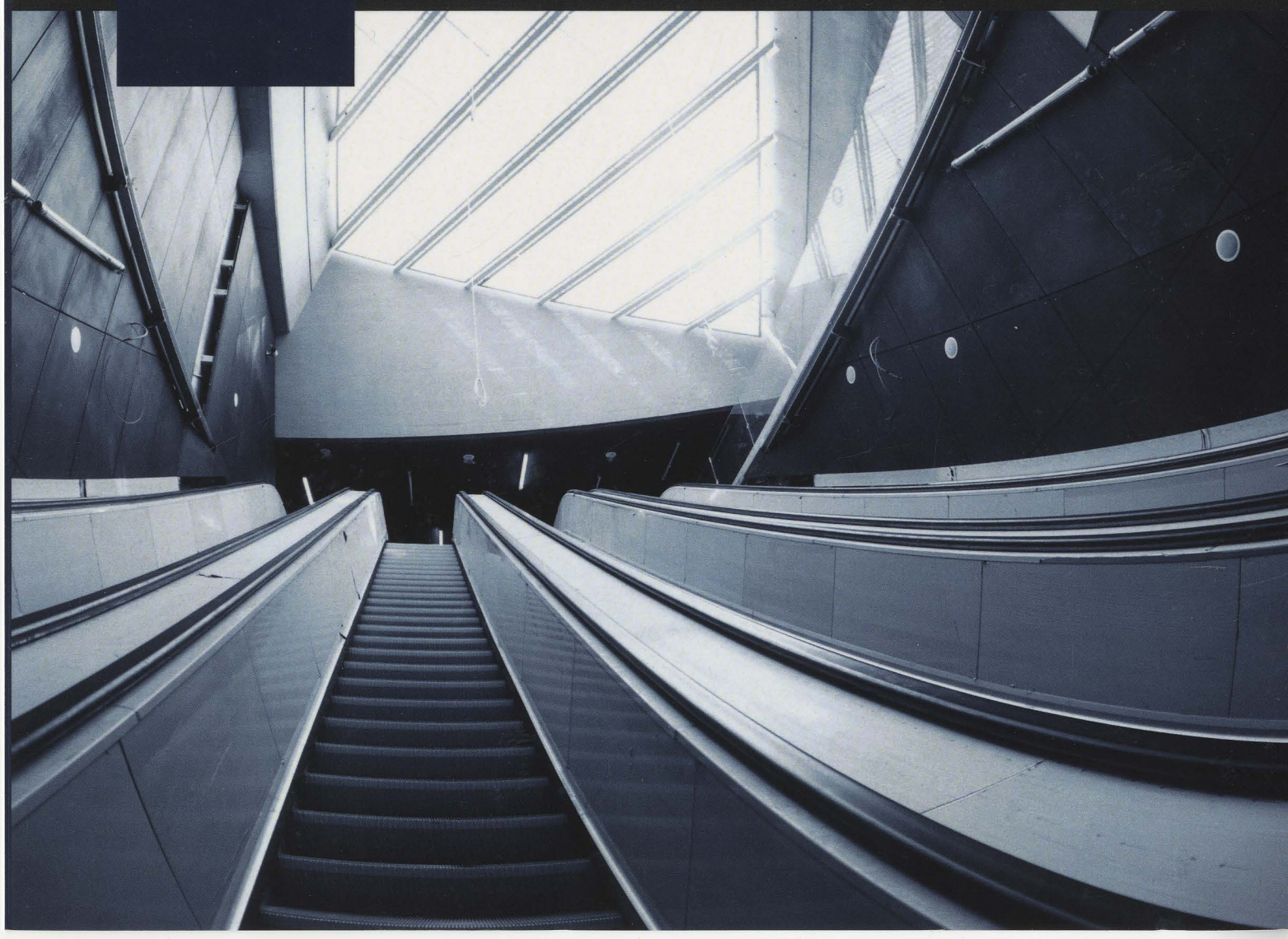
Brightwood
ARCHITECTURE EDUCATION

ARE 5.0

Practice Management

Study Guide



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INTRODUCTION

WELCOME

Thank you for choosing Brightwood Architecture Education for your ARE study needs. We wish you the best of luck in your pursuit of licensure.

ARE OVERVIEW

Since the State of Illinois first pioneered the practice of licensing architects in 1897, architectural licensing has been increasingly adopted as a means to protect the public health, safety, and welfare. Today, the United States and Canadian provinces require licensing for individuals practicing architecture. Licensing requirements vary by jurisdiction; however, the minimum requirements are uniform and in all cases include passing the Architect Registration Exam (ARE). This makes the ARE a required rite of passage for all those entering the profession, and you should be congratulated on undertaking this challenging endeavor.

Developed by the National Council of Architectural Registration Boards (NCARB), the ARE is the only exam by which architecture candidates can become registered in the United States or Canada. The ARE assesses candidates' knowledge, skills, and abilities in six different areas of professional practice, including a candidate's competency in decision making and knowledge of various areas of the profession. The exam also tests competence in fulfilling an architect's responsibilities and in coordinating the activities of others while working with a team of design and construction specialists. In all jurisdictions, candidates must pass the six divisions of the exam to become registered.

The ARE is designed and prepared by architects, making it a practice-based exam. It is generally not a test of academic knowledge, but rather a means to test decision-making ability as it relates to the responsibilities of the architectural profession. For example, the exam does not expect candidates to memorize specific details of the building code, but it requires them to understand a model code's general requirements, scope, and purpose and to know the architect's responsibilities related to that code. As such, there is no substitute for a well-rounded internship to help prepare for the ARE.

Exam Format

The six ARE 5.0 divisions are outlined in the table below.

ARE 5.0 DIVISIONS

Division	Items
Practice Management	80
Project Management	95
Programming & Analysis	95
Project Planning & Design	120
Project Development & Documentation	120
Construction & Evaluation	95

The exam presents multiple-choice questions, new hotspots, and drag-and-place, as well as incorporating case studies. Candidates may answer questions, skip questions, or mark questions for further review. Candidates may also move backward or forward within the exam using simple on-screen icons.

Appointment times for taking the exam are slightly longer than the actual exam time, allowing candidates to check in and out of the testing center. All ARE candidates are encouraged to review NCARB's *ARE 5.0 Guidelines*

for further detail about the exam format. These guidelines are available via free download at NCARB's website (www.ncarb.org).

EXAM PREPARATION

Overview

There is little argument that preparation is key to passing the ARE. With this in mind, Brightwood has developed a learning system for each exam division, including study guides, QBanks, and flashcards. The study guides offer a condensed course of study and will best prepare you for the exam when utilized along with the other tools in the learning system. The system is designed to provide you with the general background needed to pass the exam and to provide an indication of specific content areas that demand additional attention.

In addition to the Brightwood learning system, materials from industry-standard documents may prove useful for the various divisions.

Preparation Basics

The first step in preparation should be a review of the exam specifications and reference materials published by NCARB. The ARE 5.0 Handbook is available for download at www.ncarb.org.

Though no two people will have exactly the same ARE experience, the following are recommended best practices to adopt in your studies and should serve as a guide.

Set aside scheduled study time.

Establish a routine and adopt study strategies that reflect your strengths and mirror your approach in other successful academic pursuits. Most importantly, set aside a definite amount of study time each week, just as if you were taking a lecture course, and carefully read all of the material.

Take—and retake—quizzes.

After studying each lesson in the study guide, take the quiz found at its conclusion. The quiz questions are intended to be straightforward and objective. Answers and explanations can be found at the back of the book. If you answer a question incorrectly, see if you can determine why the correct answer is correct before reading the explanation. Retake the quiz until you answer every question correctly and understand why the correct answers are correct.

Identify areas for improvement.

The quizzes allow you the opportunity to pinpoint areas where you need improvement. Reread and take note of the sections that cover these areas and seek additional information from other sources. Use the question-and-answer handbook and online test bank as a final tune-up for the exam.

Take the final exam.

A final exam designed to simulate the ARE follows the last lesson of each study guide. Answers and explanations can be found on the pages following the exam. As with the lesson quizzes, retake the final exam until you answer every question correctly and understand why the correct answers are correct.

Use the flashcards.

If you've purchased the flashcards, go through them once and set aside any terms you know at first glance. Carry the rest with you throughout the day, reviewing them on the train, over lunch, or before bed. Remove cards as you

become familiar with their terms until you know all the terms. Review all the cards a final time before taking the exam.

Supplementary Study Materials

In addition to the Brightwood learning system, materials from industry-standard sources may prove useful in your studies. Candidates should consult the list of exam references in the NCARB guidelines for the council's recommendations and pay particular attention to the following publications, which are essential to successfully completing this exam:

International Code Council (ICC)
International Building Code

National Fire Protection Association
Life Safety Code (NFPA 101)

Test-Taking Advice

Preparation for the exam should include a review of successful test-taking procedures—especially for those who have been out of the classroom for some time. Following is advice to aid in your success.

Pace yourself.

Each division allows candidates at least one minute per question. You should be able to comfortably read and reread each question and fully understand what is being asked before answering. Each vignette allows candidates ample time to complete a solution within the time allotted.

Read carefully.

Begin each question by reading it carefully and fully reviewing the choices, eliminating those that are obviously incorrect. Interpret language literally, and keep an eye out for negatively worded questions.

Guess.

All unanswered questions are considered incorrect, so answer every question. If you are unsure of the correct answer, select your best guess or mark the question for later review. If you continue to be unsure of the answer after returning the question a second time, it is usually best to stick with your first guess.

Review difficult questions.

The exam allows candidates to review and change answers within the time limit. Use this feature to mark troubling questions for review upon completing the rest of the exam.

Choose the best answer.

Many candidates fall victim to questions seeking the "best" answer. In these cases, it may appear at first glance as though several choices are correct. Remember the importance of reviewing the question carefully and interpreting the language literally. Consider the following example.

1. Which of these cities is located on the east coast of the United States?
   A. Boston
   B. Philadelphia
   C. Washington, D.C.
   D. Atlanta

At first glance, it may appear that all of the cities could be correct answers. However, if you interpret the question literally, you'll identify the critical phrase as "on the east coast." Although each of the cities listed is arguably an "eastern" city, only Boston sits on the Atlantic coast. All the other choices are located in the eastern part of the country but are not coastal cities.

ABOUT BRIGHTWOOD

Thank you for choosing Brightwood Architecture Education as your source for ARE preparation materials. Brightwood brings its experience and history to the world of architectural education, pairing unparalleled resources with acknowledged experts in ARE content areas to bring you the very best in licensure study materials.

Only Brightwood Architecture offers a complete catalog of individual products and integrated learning systems to help you pass all six divisions of the ARE. Brightwood's ARE materials include study guides, QBanks, and flashcards. Products may be purchased individually or in division-specific learning systems to suit your needs. These systems are designed to help you better focus on essential information for each division, provide flexibility in how you study, and save you money.

To order, please visit
www.brightwoodarchitecture.com
or call 1-877-523-8208.

LESSON ONE

1 PROFESSIONAL PRACTICE

INTRODUCTION

The realities of having to run an architecture firm as a business, as compared to the freedom of simply solving conceptual design problems in an academic environment, may take a while for recent graduates to get accustomed to. During the years of studying to be an architect, it is easier to imagine solving the world's problems through better design than to think about such distractions as operating an office, designing within a restrictive project budget, and meeting payroll obligations. But the impact of a revolutionary, cutting-edge building is only possible if it actually gets built. And that means knowing how to practice architecture in the business world.

This division focuses on the issues related to Practice Management. What is involved in running a firm and practicing architecture? What are the legal and ethical responsibilities of being an architect? How are firms structured? What are the levels of professionalism and competence required in order to be a successful architect?

These questions, and more like them, will be answered in this book.

BUSINESS STRUCTURE

An architecture firm can range in size from one architect who manages all of the tasks of running the business to a practice that employs hundreds of people with varying job descriptions and support functions. The legal structure can be a sole proprietorship, a partnership, a corporation, or a limited liability company (LLC).

A sole proprietorship, as the name implies, is a single architect who provides architectural services. It is an unincorporated business entity and is the easiest type of business to create. It also does not provide any legal protection for the sole proprietor in case of business debt or financial obligations. All business profits or losses are reported on the sole proprietor's personal tax returns.

A partnership is when two or more people join together to share ownership of a business organization. Partnerships are relatively easy

to form, enable sharing of individual partner resources, and can take advantage of each partner's professional talents. The disadvantages of partnerships include limited liability protection, the exposure to liability caused by another partner, and potentially lower profits, as any profits must be shared among the partners. Partnerships can be divided into three subcategories: general partnerships, limited partnerships, and joint ventures. General partnerships must either share all profits equally between the partners or have the specific percentages defined in the partnership agreement. Limited partnerships can provide individual partners with limited liability, but this in turn comes with limited decision-making powers. The limits are based on the percentage of the partner's investment. Joint ventures have the characteristics of a general partnership, but they are formed only for a single project or a specific period of time. Business profits or losses are passed through to the individual partners, who must report them on their personal tax returns.

A corporation (C corporation or C corp) is a wholly independent business entity. Although it is owned by shareholders, it is legally a fully separate, unique entity. The shareholders are protected from any liability or debt incurred by the corporation. Capital is raised by selling shares in the company, and this in essence becomes the limit to the financial exposure of a shareholder. Another advantage is that corporations pay taxes separately from the owners of the corporation. Owners only pay taxes on stock dividends and the salary or bonuses paid to them from the corporation. The corporate profits are then taxed at corporate rates, which are usually lower than personal tax rates. Disadvantages of the corporate structure include initial start-up costs, increased paperwork requirements, and having to pay taxes on corporate profits as well as, in some cases, the dividends distributed to shareholders. A subchapter S corporation (S corp) is a variation of the corporate structure. One of its advantages is that only the wages paid to the shareholder employee are subject to employment taxes. Other income paid to the owner is considered a distribution, which is taxed at a lower rate, if at all. Disadvantages of S corps include mandatory director/shareholder meetings, recordkeeping requirements, and reasonable compensation-to-distribution ratios.

A limited liability company (LLC) is a business structure that provides some liability protection, similar to a corporation, but also offers the tax simplicity of a partnership. Depending on the state in which the LLC is formed, the owners (also known as LLC members) can range from a single person to multiple people, and from other LLCs to corporations. Business profits or losses are reported on the individual LLC member's personal tax returns. In an LLC, a member's personal assets gain some limited protection from business liabilities, and there are fewer restrictions on how the profits can be distributed among the members. Disadvantages include usually having to dissolve the entity if any member leaves the LLC; in addition, members are considered self-employed, which means they must pay self-employment Medicare and Social Security taxes on the net income of the LLC.

Whatever the size or the legal organization of a firm, successful practices take advantage of the skills and capabilities of the employees. Each type of firm structure has particular advantages and disadvantages. Small firms may have fewer financial overhead requirements that must be met from month to month, but large firms may be better positioned to take on large-scale projects that require more manpower and a broader range of expertise.

The identity of a firm can fall into one of six general archetypes: innovators, project-type specialists, client partners, community

contributors, project management experts, or cost and quality leaders.[1] Each type of firm approaches procuring projects, executing the work, and structuring itself in different ways. The type of architect-client relationship can also vary between the archetypes. Clients that are predominantly interested in image and attention may steer themselves to an innovator firm. Clients that are more concerned with project cost containment and delivery issues will gravitate toward a cost and quality leader. It's best when the personality of the firm matches the client's expectations for design services.

THE WORK ENVIRONMENT

When it comes to practicing architecture as a business, there are numerous rules and regulations that govern the work environment. A sole proprietor may have more leeway on certain matters, since that person is both the boss and the employee; nevertheless, there are federal and state statutes that can impact daily business operations. These regulations define which actions are permissible in a work environment and which are not. Some regulations must be posted in writing and displayed in the workplace so employees can read them.

During the hiring process, there are regulations that direct how potential employees' personal information can be obtained and used. These include the Fair Credit Reporting Act, the Drug-Free Workplace Act, the Employee Polygraph Protection Act, and the Immigration Reform and Control Act.

Minimum hourly wages, overtime requirements, and salaried employee qualifications for overtime are detailed in the Fair Labor Standards Act. Retirement and benefit plans are covered in the Employee Retirement Income Securities Act, and the Health Insurance Portability and Privacy Act specifies the privacy of employee health data. For firms with 50 or more employees, the Family Medical Leave Act mandates that employees are entitled to 12 weeks of unpaid leave in the case of serious health problems of the employee or spouse or the addition of a child through birth, adoption, or foster care.

Employment taxes and payroll tax withholding requirements are governed by the Internal Revenue Code, the Social Security Act, and mandatory unemployment insurance. Employers must withhold a certain amount of pay from an employee's paycheck for income taxes, Social Security taxes, and Medicare taxes. Employers must also make their own contribution for these taxes along with an additional amount for unemployment insurance. These funds are then deposited by the employer into the appropriate federal or state government agency account.

There are laws to prohibit discrimination in the workplace. The categories covered are gender, age, handicapped status, race, religion, or national origin. Some laws apply to firms with a minimum of 15 or 20 employees; others are applicable to all firms, regardless of size. These laws include the Civil Rights Act of 1866, Title VII of the Civil Rights Act of 1964, the Americans with Disabilities Act, the Age Discrimination and Employment Act, and the Equal Pay Act.

The Uniformed Service Employment and Reemployment Rights Act details veterans' employment rights, and the right to unionize is protected by the National Labor Relations Act. Employers must carry workers' compensation insurance (workers' comp) to cover employee work-related injuries, and the Occupational Safety and Health Act (OSHA) is intended to

1. The American Institute of Architects, *The Architect's Handbook of Professional Practice*. 14th ed. (Hoboken, NJ: John Wiley & Sons, 2008), 116.

protect employees from unsafe working conditions. Other regulations include the Sarbanes-Oxley Act, which helps to protect employee whistle-blowers, and the Jury Service and Selection Act, which mandates that employees be given time off for jury duty and prohibits the termination of an employee because of serving on a jury.

Regulations regarding the termination of employment include the Workers' Adjustment and Retraining Notification Act, which covers certain notification restrictions, and the Consolidated Omnibus Budget Reconciliation Act of 1986 (COBRA), which addresses health benefits. Issues pertaining to employment records—including how long an employer must keep such records and how they can be accessed—are also covered in various statutes.

ETHICS

Ethics refers to a person's adherence to a set of rules or values, based on moral principles of what is considered right or wrong. It is important that architects practice good ethical behavior. High ethical standards reflect positively on the profession's reputation as a whole. It is one of the intangible ways that the general public and clients alike form an overall impression of architects. Ethical behavior is also necessary when working with consultants and other architects. It shows basic respect for all members of the design team.

Duty is defined as a moral or legal obligation. It is the responsibility of persons or legal entities to abide by the terms of an agreement. The types of duty include *stated duty* and *implied duty*. Stated duty is the type codified in contracts, building codes, building regulations, and zoning documents. Implied duty is manifested by following a code of ethics.

The AIA takes the concept of ethical behavior very seriously. It is imperative that architects meet the goal of being "dedicated to the highest standards of professionalism, integrity, and competence." Refer to the AIA Code of Ethics and Professional Conduct.[2] It provides guidelines and rules for fulfilling an architect's obligations to the public, clients, users of architecture, the profession, and professional colleagues in the building industry. The obligations under the AIA Code of Ethics exist in addition to those required by the rules of professional conduct developed by individual states and other jurisdictions that regulate architectural practice.

Common violations of ethics include the following: taking credit for someone else's work, inaccurate representation of personal qualifications, claiming achievements for something not accomplished, providing examples of work not actually done, and exhibiting a lack of basic honesty.

AIA Code of Ethics

The AIA Code of Ethics is arranged in three tiers. The following descriptions are quoted from the Code:

- **Canons** are broad principles of conduct.
- **Ethical Standards (E.S.)** are more specific goals toward which Members should aspire in professional performance and behavior.
- **Rules of Conduct (Rule)** are mandatory; violation of a Rule is grounds for disciplinary action by the Institute. Rules of Conduct, in some instances, implement more than one Canon or Ethical Standard.

2. American Institute of Architects, *2012 Code of Ethics and Professional Conduct*, http://aiad8.prod.acquia-sites.com/sites/default/files/2016-04/AIA-Ethics-Code-of-Ethics-2012_0.pdf.

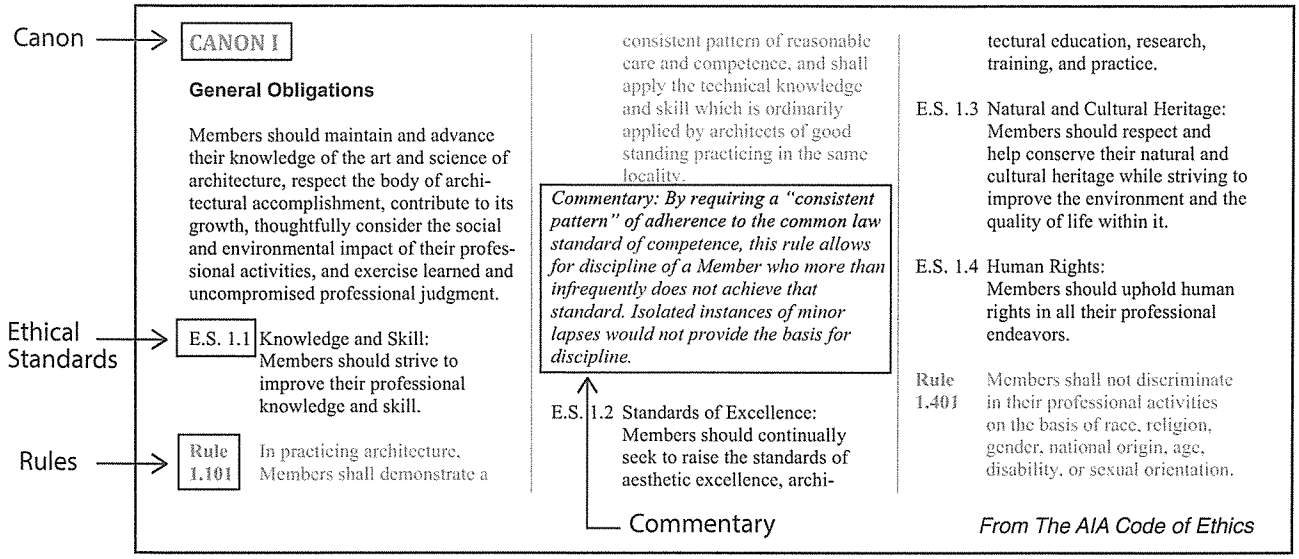


Figure 1.1

See Figure 1.1 for a sample of how the AIA Code of Ethics is structured in terms of canons, ethical standards (E.S.), and rules. There were originally five canons. The sixth canon was added to address environmental considerations. The following summary lists the canons, the headings of their associated ethical standards, and the specified procedures for their enforcement. The quoted text is taken from the Code of Ethics.

AIA Code of Ethics, Canons:

- Canon I: General Obligations
- Canon II: Obligations to the Public
- Canon III: Obligations to the Client
- Canon IV: Obligations to the Profession
- Canon V: Obligations to Colleagues
- Canon VI: Obligations to the Environment

Canon I: General Obligations

"Members should maintain and advance their knowledge of the art and science of architecture, respect the body of architectural accomplishment, contribute to its growth, thoughtfully consider the social and environmental impact of their professional activities, and exercise learned and uncompromised professional judgment."

- E.S. 1.1: Knowledge and Skill
- E.S. 1.2: Standards of Excellence
- E.S. 1.3: Natural and Cultural Heritage
- E.S. 1.4: Human Rights
- E.S. 1.5: Allied Arts & Industries

Canon II: Obligations to the Public

"Members should embrace the spirit and letter of the law governing their professional affairs and should promote and serve the public interest in their personal and professional activities."

- E.S. 2.1: Conduct
- E.S. 2.2: Public Interest Services
- E.S. 2.3: Civic Responsibility

Canon III: Obligations to the Client

"Members should serve their clients competently and in a professional manner, and should exercise unprejudiced and unbiased judgment when performing all professional services."

- E.S. 3.1: Competence

- E.S. 3.2: Conflict of Interest
- E.S. 3.3: Candor and Truthfulness
- E.S. 3.4: Confidentiality

Canon IV: Obligations to the Profession

"Members should uphold the integrity and dignity of the profession."

- E.S. 4.1: Honesty and Fairness
- E.S. 4.2: Dignity and Integrity

Canon V: Obligations to Colleagues

"Members should respect the rights and acknowledge the professional aspirations and contributions of their colleagues."

- E.S. 5.1: Professional Environment
- E.S. 5.2: Intern and Professional Development
- E.S. 5.3: Professional Recognition

Canon VI: Obligations to the Environment

"Members should promote sustainable design and development principles in their professional activities."

- E.S. 6.1: Sustainable Design
- E.S. 6.2: Sustainable Development
- E.S. 6.3: Sustainable Practice

Rules of Application, Enforcement, and Amendment

"The Code of Ethics and Professional Conduct applies to the professional activities of all members of the AIA."

AIA bylaws outline the procedures for enforcing the code. These include the following:

1. Enforcement is administered through an appointed council.
2. Formal charges are filed with the council.
3. Possible penalties for infractions include
   a. admonition,
   b. censure,
   c. suspension of membership, and
   d. termination of membership.
4. The decision of the council may be appealed.
5. All procedures and admonishments are confidential, but other penalties must be made public.

There are some issues to note regarding the Code of Ethics. It does not prohibit campaign contributions (E.S. 2.1); members should not undertake projects that are beyond their professional capacity (E.S. 3.1); members cannot claim or imply credit for work they did not do (E.S. 4.2); and members may impose reasonable copying costs for reproducing work taken by departing personnel (E.S. 5.3).

PROFESSIONAL STANDARDS

The law does not require perfection in meeting a client's expectations. The law grants architects the same latitude it provides lawyers, doctors, and other professionals—the freedom to exercise their judgment and skill reasonably and prudently. An architect must do what any reasonably prudent architect would do in the same community, in the same time frame, given the same facts and circumstances.

This standard of reasonable care establishes the law's underlying minimum expectations for professional performance, and it can be modified by contract or conduct. Simply meeting the relevant standard of care may not protect an architect from litigation, however. An architect may consciously or inadvertently raise the standard of care above the minimum levels. Examples of this include the following: an architect agreeing in a contract to warrant that the building will be constructed as designed;

an architect signing a financial institution's document certifying that the project has met all codes and standards; and an architect visiting a construction site and instructing the contractor on the means and methods of forming a complicated concrete wall.

An architect who fails to meet the standard of reasonable care may be held negligent in the performance of professional duties if any injuries or damages result from their failure. Negligence may lead to liability, which is the legal responsibility for injury or damage to another person or property. Architects can protect against liability through an overall strategy to minimize risk. Risk management will be further discussed in Lesson 3.

SUMMARY

In this lesson we have covered business structure, the work environment, ethical behavior, and appropriate standards of professional care. These non-design aspects of practicing architecture are just as important to creating a successful practice as award-winning projects and name recognition. Traditionally, architecture has been viewed as an honorable profession. Architects are generally motivated to make the world a better place, improve the lives of building occupants, and provide worthwhile services to clients. The topics covered in this lesson provide a foundation that enables architects to achieve those goals.

LESSON 1 QUIZ

1. Which one of the following types of business entities is the easiest to form?

   A. C corp
   B. LLC
   C. Sole proprietorship
   D. S corp
   E. Partnership

2. Which of the following is NOT considered a disadvantage of a partnership business structure?

   A. Exposure to liability caused by another partner
   B. Any profits must be shared among partners
   C. Limited liability protection
   D. Initial start-up costs

3. Minimum hourly wages, overtime requirements, and salaried employee qualifications for overtime are detailed in which regulation?

   A. Social Security Act
   B. Fair Credit Reporting Act
   C. American with Disabilities Act
   D. Civil Rights Act
   E. Fair Labor Standards Act

4. Which of the following are associated with implied duty?

   A. Building codes
   B. Building regulations
   C. Contracts
   D. Code of ethics
   E. Zoning documents
   F. All of the above
   G. None of the above

5. The following description applies to which canon from the AIA Code of Ethics and Professional Conduct? "Members should maintain and advance their knowledge of the art and science of architecture, respect the body of architectural accomplishment, contribute to its growth, thoughtfully consider the social and environmental impact of their professional activities, and exercise learned and uncompromised professional judgment."

   A. Canon I: General Obligations
   B. Canon II: Obligations to the Public
   C. Canon III: Obligations to the Client
   D. Canon IV: Obligations to the Profession
   E. Canon V: Obligations to Colleagues
   F. Canon VI: Obligations to the Environment

LESSON TWO

THE ARCHITECTURAL DESIGN TEAM

STRUCTURING THE ARCHITECTURAL DESIGN TEAM

This brief lesson discusses architectural team organization by looking at how design teams can be structured, coordination issues involved in working with consultants, and issues to consider when assembling a team to work on a sustainable design project.

The architect can act as the sole provider of design services if the architect's firm has experienced and qualified in-house staff that can provide the necessary engineering and other specialty services that are required on a project. However, most architects typically form alliances with other firms to provide these services.

In a typical alliance, the architect has the prime contract with the owner and then subcontracts services to other professional firms that act as the architect's consultants for a project. Consultants can include structural, mechanical, electrical, plumbing, civil, or acoustical engineers; landscape design firms; kitchen design consultants; information technology/communications firms; and soil and construction testing services firms.

Architects may also create joint ventures with other firms, creating a single project-based entity with other architecture, engineering, or construction firms that have specific areas of expertise or geographical experience. An architect would typically form a joint venture with a construction firm as part of a design/build delivery method, and would then act as a vendor rather than as an owner's agent. Acting as a vendor would then require the architect to act on behalf of the joint venture and its best interests rather than for the owner.

An architect may also act as one of several independent design and engineering firms hired by an owner. In this situation, an owner would typically have some level of project and construction management capabilities to handle and coordinate the different contracts.

CONSTRUCTION DOCUMENTS OF CONSULTANTS

General Coordination

A coordinated and detailed response to code requirements from the entire design team is essential to the success of a project. Lesson 9 will go into more detail regarding the architect's relationship with consultants. Some of the general guidelines are noted here, however.

Initially, architects should verify that each member of the project team is working from the same set of code requirements. Consultants should inform the architect about significant aspects of their work that are required by code. Although codes generally allow several responses to requirements, they occasionally require specific design features. Consequently, architects must know which design elements may change and which may not.

Architects are responsible to notify their consultants of design decisions that have code implications.

Although architects can check for internal consistency and for apparent compliance with standards, consultants are primarily responsible for quality control of their own work.

Architects should review consultants' construction documents with the construction process in mind. The sequence of construction and workability of the scheme throughout the construction process must be considered. Major building elements must fit into place at the appropriate time and without disrupting other ongoing activities.

Architects' consultants must be involved in scheduling to enable major items to be available when needed. Contractors are often selected too late to order long-lead-time equipment in a timely manner. One solution is for the owner, on the advice of the architect and consultants, to order equipment directly. When a contractor is subsequently selected, purchase orders are assigned from owner to contractor. Upon delivery, the items are received and installed in the same way as if the contractor had been involved from the beginning.

Consultants must also be aware of overall construction schedules and, within these schedules, pertinent installation periods. If a new chiller or cooling tower is required before summer, or a new boiler or heating plant before winter, engineering designs must allow equipment to be built and installed in time. Or, if construction must occur during winter months, structural engineers may want to avoid the use of reinforced masonry, which requires special measures to protect mortar from freezing.

THE SUSTAINABLE PROJECT DESIGN TEAM

Is a sustainable design organized and implemented differently than a conventional design?

Design Team

What kind of design team is necessary for a sustainable project?

The scope of sustainable design invites an expanded team approach, which may include the following:

- Architects or engineers (structural, MEP) with energy modeling experience
- A landscape architect with a specialty in native plant material
- A commissioning expert (if LEED employed)
- An engineer/architect with building modeling experience

The design team for a sustainably designed project tends to have a larger pool of talent than a typical architectural project. Because the buildings will be more holistic, the sustainable design team will have additional consultants that bring a broader range of experience and innovation to the project. Wetlands, scientists, energy efficient lighting consultants, native plant experts, or commissioning engineers are examples of the additional talent that may be added to sustainable design project.

As with any architectural design, there is a hierarchy of design goals:

- *Initial imperatives* such as budget, timing, image, and program necessities
- *Subjective goals* such as a functionality improved and more pleasing work environment, pleasing color schemes, and landscaping that complements the architecture
- *Specific goals* such as more open space, more natural light, less water usage, and adjacency to public transportation

And with the inclusion of sustainability, there may be additional goals:

- *Initiatives that are specific to sustainability* such as fewer toxins brought into the space, daylighting in all spaces with people occupancies, less overall energy consumed, less water usage, adjacency to public transportation, and improved indoor air quality
- Desire to exceed existing standards such as ASHRAE, USGBC, or American Planning Association (APA)

SUMMARY

The integration of the design team typically relies on the architect's ability to coordinate and manage the resources at hand. As challenging as the task may be, it is ultimately one of the most important steps towards the realization of a successful project.

LESSON THREE

3

DEVELOPING THE PRACTICE

INTRODUCTION

This lesson examines financial considerations, management of risk, and strategic business policies related to running a firm. Architects can implement strategies to help keep their practices on sound financial footing and reduce the potential of facing legal proceedings.

FINANCES

Financial planning doesn't necessarily have to be complicated. It is something most people do in the course of their daily activities. Whether the question is to buy more gas for the car, purchase the latest and greatest cell phone, or accept a new job offer, people make decisions based on financial assessments all the time.

The basic questions that someone addresses before making a purchase or investment typically include the following: What are the short-term costs? What are the long-term costs? What value is returned because of the action? Are those benefits worth the cost? Is the cost affordable?

When managing an architectural practice, those decisions can involve whether or not to buy new computers, to reduce or hire more staff, or to pursue large-scale projects. It is best when these decisions are made based on a rational plan or a logical assessment of the overall financial implications to the firm.

There are two ways an architectural practice can assess its resources to determine what the required billing rates and profit goals should be. One method is to first estimate the firm's revenue, and then determine the staffing needs, calculate the overhead expenses, and create a profit plan. The second method is to first determine the staff expenses, overhead costs, and profit targets, and then calculate what the billing revenue needs to be. After the billing rates and profit goals are established, periodic monitoring and reassessment should take place to ensure that the firm is meeting its financial expectations.

Like any business, architecture firms need to manage the three facets of financial health in order to survive: profitability, liquidity, and

solvency. Profitability is the effectiveness of generating more income than expenses; liquidity is the proficiency of converting resources into cash when required; and solvency is the ability to pay bills on time.

Revenues from projects must be accurately predicted and collected to maintain an adequate cash flow. If the firm's billings fall short of necessary levels, capital reserves may need to be used to meet operating expenses.

Direct expenses are specifically related to a project. Indirect expenses are the general costs of maintaining and operating the firm. They are the overhead costs not tied to a specific project. The total amount of indirect expenses, divided by the total of direct salary expenses (DSE), produces what is known as an indirect expense factor. The indirect expense factor is a ratio that typically ranges from 1 to 2. A value of 1.5 would mean that $1.00 in direct salary expense requires $1.50 in indirect, overhead expense, or $1.50 of indirect expense is required for each $1.00 of DSE.

MANAGING RISK

Managing risk is another aspect of operating an architectural practice. Risk management is when architects protect against liability through an overall strategy to minimize risk. Liability is the legal responsibility for injury or damage to another person or property. It can be caused by negligence, which is the failure to use due care. It can also be created by someone else's negligence. To limit exposure to liability, architects must comply with stated duty, fulfill implied duty, implement well-written contracts, maintain effective quality control programs, document project decisions, note client approvals, and carry sufficient insurance.

Negligence

As mentioned earlier, negligence is the failure to take proper care which results in harm or damage to another party. For an architect to be successfully sued based on negligence, four conditions must be met:

1. *Duty*. The architect must have an obligated duty to the suing party.
2. *Breach*. The architect did something that he should not have done or failed to do something that he should have done.
3. *Cause*. The actions or non-actions of the architect are the cause of the harm to the party bringing the suit.
4. *Damage*. Actual harm occurred to the suing party because of the breach by the architect.

Examples of negligent actions include the following:

- Failure to follow building codes, zoning ordinances, appropriate regulations, and so on
- The architect consciously following an instruction from the owner, understanding that is in violation of a code or regulation
- The architect issuing a change order without the proper owner approval or missing an easily identifiable error in a contractor's application for payment
- The building is structurally deficient for site conditions, such as wind loading

Risk Management

Risk management begins with a strategy for identifying and evaluating different kinds of risk. The time and materials needed to control risk should be identified in each phase of a project. Architects should plan for risk and develop a policy regarding the kind of risks they are comfortable with taking. They should

have a methodology for determining the pertinent information and then how to logically analyze the facts. It may be possible to establish a framework for assessing risk and then "fill in the blanks" as information becomes available. The office staff should be aware of how the firm will manage risk. There are four basic ways to deal with risk: retain it, reduce it, transfer it, or avoid it.

The first option for dealing with risk is to retain it. If there is a low probability that the situation in question will arise, the exposure to damages is minimal, and the architect has enough authority to lessen the chances of the situation occurring, then the architect generally accepts the risk. The AIA owner-architect agreements identify risks that both the architect and the owner typically retain.

The second option is to reduce it. Actions can be taken by the architect to reduce the chances that a given situation might occur. These actions may include providing enhanced services to identify potential issues before they become a problem or employing experts to consult on specific design features while the project is still being developed. Liability can also be reduced through damage waivers or limits written into the contract.

The third option for dealing with risk is to transfer it. Insurance companies will take on a risk in exchange for the premiums paid to that insurance company by the policyholder. Risk can also be transferred through specific provisions or contractual indemnities. Relevant types of insurance include professional liability insurance, general liability insurance, personal insurance, property insurance, and workers' compensation. Insurance is discussed in more detail below.

The fourth option for managing risk is to avoid it. When risks cannot be retained, reduced, or transferred, and the chances of negative consequences are too great for the firm, it might be in the best long-term interests of the firm to decline the work. This might entail not working for particular clients; not undertaking certain types of projects; or planning to not perform specific aspects of a project and noting those decisions in the contract beforehand.

Insurance

Professional liability insurance protects the architect in case some action by the architect causes bodily injury, property damage, or other damage. It can also be called *malpractice insurance* or *errors and omission (E&O) insurance*. It covers problems related to incorrect specifications, mistakes on drawings, and negligence. Many owners, as well as some states, require the architect to carry E&O insurance.

General liability insurance protects the architect against claims or property damage, liability, and personal injury caused by the architect, firm employees, consultants, or other people hired by the architect. General liability insurance is the coverage used to protect the architect in cases where the architect does not coordinate the project documents sufficiently with a consultant's documents. In some situations it may be advisable for architects to purchase general liability insurance to safeguard against the possibility that one of the consultants does not carry proper insurance.

Other types of insurance include the following: personal insurance, which is used to protect against claims of slander, defamation of character, and so on; property insurance, which is used for damage to property caused by a specific peril or an act of God and can be written to specifically cover such perils or to specifically exclude them; workers' compensation

(workers' comp) insurance, which covers accidents occurring at work; health insurance; life insurance; and disability insurance.

Statutes of Limitations

Statutes of limitations relating to breach of contract and professional negligence are not uniform in application. They can differ based on jurisdiction. In one location, a breach-of-contract legal action may have to be filed within a year, and a professional negligence suit may have to be submitted within four years. But in another location, there may not be any specific time limits at all. Statutes of limitations establish the time period within which a legal action must be filed, starting from the date that a defect in the project was discovered or that an injury occurs. Statutes of repose base the beginning of this time period on the building's certificate of occupancy or the completion date of construction. Some jurisdictions have both statutes of limitation and statutes of repose. Other jurisdictions have only statutes of limitations.

Agency

Agency is when a person or entity represents someone else and acts on that person's behalf. It is possible for the actions of agents to legally bind principals to particular situations. Architects can become agents of the owner, which gives them the authority to perform certain duties, but in so doing they may also commit the owner to specific legal responsibilities. Employees of a firm or outside consultants can become agents of the firm, gaining the authority to contractually obligate the firm in certain circumstances. Agency can also be implied by the actions of a party if those actions can be interpreted as representing the principal. It is important for architects to define the scope of their agency powers in contractual language. Inadvertently assuming an agency persona can lead to legal exposure and financial risks for the architect.

OPERATIONAL CONSIDERATIONS

Running an architecture firm involves more than just knowing how to design a building. It also requires knowledge about managing people, pursuing new projects, making a profit, and keeping up with developments in office technology. The administration of a firm can be divided into the following areas: office administration, finance, human resources, marketing, project administrative support, and information technology. Whether it is a sole proprietor who handles all of these responsibilities or a large multidisciplinary firm with dedicated staff to perform the tasks, these issues must be addressed.

Office administration comprises the day-to-day operations of running an office. This includes representing the firm on the telephone, maintaining adequate equipment supplies, writing reports, and helping to enact general operational procedures. Daily office administration is valuable for supporting the professional architectural aspects of the firm.

Financial considerations include maintaining accounting software, processing payroll, preparing invoices, paying bills, monitoring budgets, working with certified public accountants (CPAs), and filing government forms. In addition to the long-term fiscal planning and financial liability issues discussed previously, daily financial obligations can have significant impacts on the viability of the firm.

The role of human resources covers the staffing component of a firm. This can include conducting interviews for job openings, writing performance evaluations, investigating employee

insurance plans, and maintaining employee records. It is also concerned with ensuring the compliance of the firm with federal and state employment laws and regulations.

Marketing involves the publicity and promotion of the firm. This can involve writing press releases regarding noteworthy projects, keeping the firm's website up to date, or meeting with potential clients. Having future projects "in the pipeline" is a valuable long-term strategy.

Project administrative support can be as simple as providing and distributing project binders. More involved assistance by project managers can include helping to create specifications, preparing contracts, and maintaining project management software. Project administrative support can also include coordinating and monitoring the office sample library.

The information technology (IT) role is a large responsibility in many firms, whether the practice is a single person or is composed of 200 architects and engineers. While it is true that some firms still work only on drawing boards with pen and pencil, those firms are a small minority in the architecture profession today. IT is responsible for maintaining computer hardware, installing devices, managing software packages, monitoring the network infrastructure, performing computer backups, conducting system diagnostics, and archiving completed project files. Some IT positions may also involve managing the firm's website.

SUMMARY

The financial, legal, and operational aspects of maintaining a successful architecture practice can seem daunting. Architects must be well-versed and competent in these non-design areas. Whether an architect takes on these additional responsibilities directly, hires consultants, or employs properly trained people to deal with the tasks, it is important that they are adequately addressed.

LESSON 3 QUIZ

1. Regarding the financial health of a firm, which of these must be taken into consideration?

   A. Solvency
   B. Profitability
   C. Liquidity
   D. All of the above
   E. None of the above

2. If an architectural firm has an indirect expense factor of 1.33, for each $1.00 of DSE, what is the indirect expense required?

   A. $0.33
   B. $0.75
   C. $1.00
   D. $1.33
   E. $2.33

3. Which of the following is NOT a requirement that needs to be met for an architect to be sued for negligence?

   A. Cause
   B. Breach
   C. Damage
   D. Duty
   E. Agency

4. Which type of insurance would protect the architect for incorrect specifications?

   A. Workers' compensation
   B. E&O
   C. General liability
   D. Personal liability
   E. Property
   F. All of the above
   G. None of the above

5. Under which of the following would a certificate of occupancy issuance date be used as the beginning of the time period during which it is permissible to bring suit against the architect for professional negligence?

   A. Statutes of repose
   B. Statutes of occupancy
   C. Statutes of liability
   D. Statutes of negligence
   E. Statutes of limitations

LESSON FOUR

4

PROJECT DOCUMENTATION AND RISK

PROJECT FILES

Contract Documents and Project Records

Neither the AIA Owner-Architect Agreement (Document B201) nor the AIA General Conditions (Document A201) contains specific requirements for the architect to maintain project files. However, it is good business practice to keep records and documents filed in an orderly manner. This lesson will cover some of the other records that an architect normally keeps on file during the project and for an appropriate time thereafter.

There are a number of AIA forms to facilitate gathering and maintaining project data. AIA Document G809, Project Data, is designed to record basic information about the project, such as the project location, the owner's name and address, a basic description of the proposed improvements, the site description, the names of the owner's legal, insurance, and other advisors, the names and addresses of the utility companies that serve the site, relevant financial data, and proposed methods for contracting. By completing this document, the architect is able to keep a permanent record of the owner's team

and keep them informed about developments during the course of the project.

AIA Document G807, Project Directory, provides the architect with a format for information about the architect's staff, consultants who are working on the project, and the contractors who are hired by the owner. By updating the document as necessary, the architect can keep the design and construction team informed about developments, and avoid uncertainty about whom to contact regarding problems, meeting schedules, notices, etc.

The AIA also publishes a form for listing subcontractors and others who will be employed on the project by the contractor. AIA Document G705, List of Subcontractors, is filled out by the contractor and sent to the architect. Although the architect usually has no direct contact with subcontractors and other parties under contract to the contractor, the architect needs to maintain a record of the various subcontractors performing work on the project. In the event of claims against the project, this information will save considerable time for the attorneys representing the architect and the owner.

To assist in the administration of the bidding phase, AIA Document G804, Register of Bid Documents, enables the architect to list information including the amount of the bid deposit, if required, the costs for sets of drawings as well as single sheets of documents, and when and where bids are to be submitted. The form also provides for a listing of each recipient of bid sets so that the architect can distribute addenda to each bidder, and monitor bidders' deposits and return of bid sets. The record of the distribution of addenda can be particularly important. Addenda can have a considerable impact on the bids that are received and on the final scope of the contract requirements.

In addition to the basic information about the project, the architect must keep complete copies of all contracts to which she is a party. Files should be established for the owner-architect agreement, amendments, and written authorizations for additional services. Similar files should be established for each contract between the architect and the engineers and other consultants. Records related to the fulfillment of the professional service contract, such as copies of billing statements and owner approvals at milestones such as completion of the schematic design and design development phases and approval of the construction documents for bidding, should also be kept.

Before the start of construction, the architect should obtain a copy of the contract between the owner and the contractor, including the agreement, the general and supplementary conditions, the drawings, specifications, and all addenda. During the construction phase, this file should be updated as change orders are agreed to by the owner and contractor. If the owner's attorney prepares the owner-contractor agreement, the architect should also obtain a copy for her files.

Construction Administration Procedures

The scope of the architect's services during the construction phase is defined in the AIA Owner-Architect Agreement (Document B201), as well as in the AIA General Conditions (Document A201). Proper performance of construction phase services begins with an understanding of what is contractually required of the architect. The three most important areas requiring proper administrative procedures are: processing of submittals, evaluation and preparation of change orders, and certification of payment applications. Each of these subjects has been covered in detail in earlier lessons.

In addition to recordkeeping related to fulfillment of contractual duties, the architect may be asked to attend meetings and to prepare minutes of those meetings. This duty can include private meetings between the owner and the architect, as well as meetings attended by several parties, such as the owner, the contractor, professional consultants, and others. Often, the architect may be assigned the responsibility of taking notes to document decisions reached at such meetings, and to distribute copies of records to the attendees.

For large or complex projects, the owner may authorize the architect to hire, as a Change in Services, a full-time on-site project representative to provide a higher degree of monitoring of the progress of the work than might otherwise occur. Unlike the basic construction phase services where the architect visits the site only when necessary to observe important aspects of the work or to generally evaluate its progress or quality, the full-time project representative is expected to be at the site whenever work is in progress. The scope of the project representative's duties should be defined in a written attachment to the owner-architect contract.

AIA Document B207 should be given to the contractor to avoid misunderstandings about the limitations on the project representative's duties. For example, under certain circumstances, the representative may not be authorized to make decisions in the field, but must refer matters to the architect.

The architect's full-time project representative should not be confused with the *clerk of the works*, which refers to a person employed by the owner to check on matters at the site and to maintain records of the progress of construction. Because the clerk of the works usually is employed by the owner, his or her presence at the site can create problems. For example, the contractor may be uncertain about whether to consult the architect, the architect's on-site representative, or the owner's clerk of the works. A division of authority can lead to confusion, conflicting instructions, and potential claims against the owner.

Correspondence

Preparing proper correspondence and maintaining correspondence files are extremely important. Copies of correspondence should be filed by topic, as well as chronologically. The chronological file is especially important to show the evolution of the project, in the event of a claim. Construction projects are usually complex and take place over long periods of time, and correspondence that details each step of the project's development may be the only record of what actually happened. Written documentation reduces the likelihood that important items will be overlooked or that misunderstandings will occur. For example, if a letter from the contractor requests information or a decision, the request must be acknowledged and responded to promptly. If the decision or information requested cannot be provided, a letter of explanation should be sent.

Correspondence may be supplemented by photographs, videotape, and/or audio tape to document site conditions, meetings, etc. These should also be filed with the project records.

To expedite the transmittal of other documents and to reduce the need for formal letter writing, the AIA publishes Document G810, Transmittal Letter. The use of this document provides the architect with a written record of what was sent to whom and when it was sent. The form also has space to indicate the purpose of the transmittal. Some architects use transmittal letters, which are printed in multiple copies, to facilitate internal recordkeeping. Others use the AIA form and make file copies after filling in the blanks.

If problems arise during the course of the project, the architect should review correspondence with his or her attorney. When letters are received from the contractor or owner alleging deficiencies in the contract documents or the architect's services, the architect's legal counsel should be asked to review the correspondence and to assist in preparing responses. If actual claims are made against the architect, the architect's professional liability insurance carrier should be notified immediately so that a claims representative or an attorney can be assigned to advise on how to respond. The architect must remember that any written document could be entered as evidence in court during a lawsuit. This does not mean that the architect should avoid written documentation, but only that it should be done carefully and factually. When in doubt, legal or insurance counsel should be consulted.

Architect's Relationship to Owner and Contractor

The AIA General Conditions assigns the architect the role of an intermediary between the owner and contractor. Subparagraph 4.2.4 of AIA Document A201 states, in part, that... *the Owner and Contractor shall endeavor to communicate with each other through the Architect...*

Throughout the General Conditions, the contractor is required to submit documents to the architect, not directly to the owner. For example, this requirement applies to the contractor's application for payment, shop drawings and samples, and various documents during the closeout of the project at the end of the construction phase. All parties to the project expect the architect to maintain copies of these documents and to keep them organized in an adequate filing system.

Shop Drawings and Schedules

The specifications state the requirements for the submission of shop drawings and the preparation of schedules. At the start of the construction phase, the contractor should prepare a schedule for the submission of shop drawings. The purpose of this schedule is to notify the architect when to expect submittals from the contractor, and when approved shop drawings must be returned to the contractor.

The architect's project files should contain a copy of each shop drawing, with the approval stamp and signature of the architect, the architect's consultants, if applicable, and the contractor to show that the shop drawing was processed in accordance with contract requirements. Sophisticated owners may sometimes process shop drawings with their own technical staff. If this is the case, the architect should also maintain a record of the distribution of the shop drawings in accordance with the owner's requirements. The shop drawing schedule must allow time for the shop drawing to be transmitted to, and reviewed by, all appropriate parties.

The architect should retain copies of all shop drawings for a reasonable period of time after the completion of construction. This includes not only the final approved set of shop drawings, but also intermediate submittals that were not approved. The shop drawings help to document the progress of the project. In the event of any claims, a record of what was approved or rejected, and when the action occurred, can play an important role in the resolution of such claims.

When files are cleaned out, old shop drawings are often the first documents to be discarded. As with all project files, nothing should be thrown away until the expiration of the statute of limitations applicable to the architect's services or to the project. The architect should

ask if the owner has a need for the project documents before they are destroyed. Clients sometimes rely on the architect to maintain construction records because they do not have the facilities themselves. If the owner plans an expansion or renovation of the project, the architect may supply copies of the drawings. By anticipating the client's needs, the architect can build a strong business relationship with the client.

Record Drawings

Record drawings show field changes that occurred during construction, which vary from the information shown in the working drawings. Record drawings are sometimes referred to as *as-built drawings*. Use of that term should be avoided, since no set of documents can ever show the project exactly as built, and using the term may create a liability exposure.

The owner generally decides whether to require the preparation of record drawings. Since the AIA General Conditions does not cover the preparation of record drawings, if they are required, the procedures are usually indicated in Division One, General Requirements of the Specifications. The recommended procedure is for the contractor to mark up a set of prints in the field showing the changes as they occur during construction. The contractor is responsible for the supervision of the work and is in the best position to know what changes are being made to the work. If changes involve additional or reduced cost or time, they must be documented by the issuance of a change order. Other changes, not involving adjustments in cost or time, can be recorded by supplemental instructions. Some minor changes may simply occur in the field without a change order or supplemental instructions. Field changes should be recorded by the contractor on a set of record prints at the site. This record is invaluable if and when future repairs or modifications to the project are required. The exact location of items, such as underground high voltage lines, must be carefully documented to prevent the possibility of serious injury or death in the event future work is required in the area.

Once the contractor has marked up the changes on a set of prints at the site, the notations should be transferred onto a permanent reproducible medium, such as mylar drafting film or CAD files. The backgrounds used should be the current version of the contract documents, including all revisions issued during construction. If the owner chooses to authorize the architect to transfer the notations, these services are normally considered a Change in Services under the Owner-Architect Agreement. Otherwise, the contract documents should require the contractor to transfer the notations.

Normally, the architect has no obligation to verify if the information provided by the contractor on the marked-up set of record prints accurately represents the installed work because the architect is not continuously at the site during construction and does not control the activities of the construction workers. However, the contractor, whose superintendent is always present at the site, is expected to be aware of all changes made to the construction and is expected to note these changes on a set of record prints.

Warranties

A warranty is a legally enforceable promise made by one party to another about something that will or will not happen or about certain circumstances. There is no legal distinction between the terms *warranty* and *guarantee*. On construction projects, warranties are often required to establish performance standards. If the standards are not met, the breach of the warranty would entitle the owner to recover monetary damages.

The AIA General Conditions requires the contractor to give a broad warranty to the owner about the quality of the work. Paragraph 3.5 of AIA Document A201 states:

> *The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except those inherent in the quality of the Work the Contract Document require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.*

If the work is not of good quality, free from faults and defects, or is not in conformance with the contract requirements, the contractor will have breached the warranty and will be liable to the owner for all damages that result.

In addition to the broad warranty contained in Paragraph 3.5 of the AIA General Conditions, the contractor also may be required to provide the owner with specific warranties related to the operation of mechanical systems and other items of equipment. Often, these warranties are given by the equipment manufacturers and are simply passed through by the contractor to the owner. The requirements for warranties are usually specified by the architect in the appropriate sections of the technical specifications. If the architect has any questions about the precise terms of any warranty, he or she must ask the owner's attorney to prepare the appropriate legal language for the specifications.

After the work has been performed, the contractor is required to assemble the manufacturers' warranties and forward them to the architect. Subparagraph 2.6.6.1 of the AIA Owner-Architect Agreement (Document B201) requires the architect to receive and forward these warranties to the owner for review. If there are any discrepancies between the terms of the warranty required by the specifications and the terms of the warranty provided, the owner's attorney should resolve this matter with the contractor. The contractor cannot avoid contractual responsibility by claiming that the manufacturer will not provide the warranty required by the specifications.

PROJECT COMPLETION

Compliance with Contract Documents

When the contractor has fulfilled all the requirements of the contract documents, his obligations are over, subject to remedying defective work that may appear within a year and any liability for breach of contract until the expiration of the statute of limitations. Due to the complexity of most projects, determining project completion can require a great deal of the architect's time and effort. The architect must inspect the work, and she may be required to mediate the competing interests of the owner and contractor. The owner may be anxious to occupy the project, but not if work remains that would interfere with the owner's use of the premises. As the project nears completion, the contractor may minimize the importance of the remaining work because he usually wants to establish the earliest date of substantial completion, get paid, and move on to other projects. At this point, there may seem to be a never-ending series of minor problems that cannot

be resolved. The painter may be committed to other work and unable to get back to touch up some walls. A part may be missing for a piece of equipment, and the manufacturer may be unable to promise a delivery date. Whatever the problems, they prevent completion of the project, which can be frustrating for all parties.

The owner relies on the architect to determine whether the contractor's work complies with the requirements of the contract documents. This evaluation is continuous throughout the construction phase. Each of the contractor's applications for payment must be evaluated by the architect to determine compliance with the contract documents for work completed to date. A systematic approach to periodic evaluations of the work in progress facilitates the final evaluation during completion of the project. The remaining work and correction of work should be readily identifiable for inclusion on the contractor's *punch list*, and completion can be verified as the work is performed.

Assembling Documents

The AIA Owner-Architect Agreement (Document B201) requires the architect to forward certain documents to the owner as part of the architect's services related to closing out the project. Subparagraph 2.6.6.1 states:

> *The Architect shall conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion; receive from the Contractor and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract Documents and assembled by the Contractor; and issue a final Certificate of Payment based upon a final inspection indicating the Work complies with the requirements of the Contract Documents.*

The contractor's obligation to assemble warranties and documents is defined by the contract documents, both in the general conditions and the specifications. The contractor may prepare a binder to organize operating manuals and other documents that the owner may need to properly maintain equipment and other parts of the project. Warranties required by the contract documents may either be included in the binder or forwarded separately. The architect must know what is required by the contract documents so that documents forwarded by the contractor can be verified as they are received.

If the architect believes that any warranties forwarded by the contractor are not in compliance with the contract requirements, the architect should alert the owner so that the owner can request his or her attorney to review the warranties. The architect should not judge the legal sufficiency of warranties. A warranty may meet the requirements of the contract documents, but the precise language in the warranty may be different from that required by the contract. Conversely, the warranty may not meet contract requirements, and the owner may have to decide whether to accept the warranty as given, or to demand that the contractor furnish the warranty as required. The contractor may claim that the warranty is merely being forwarded from the manufacturer, and the manufacturer will not provide a warranty that meets the contract requirements. In this situation, the owner still has the right to insist that the contractor provide the warranty required by the contract documents. The owner does not have to accept a lesser warranty simply because the contractor is having a problem with one of his suppliers. The architect should limit his involvement in this situation to providing the owner with technical assistance. Leave the legal arguments to the owner's attorney.

Substantial Completion and Final Completion

As part of closing out the construction phase, the architect is required to inspect the project to determine whether the contractor has achieved substantial completion and, subsequently, final completion. Substantial completion means that the work has progressed to the point where the owner can occupy or utilize the work or designated portions.

Inspections by the Architect

The contractor is required by the AIA General Conditions to prepare a list of items of work to be completed or corrected at the time that he or she claims that the work is substantially complete. In some areas, the local practice is to have the architect prepare this list, called the *punch list*, contrary to the provisions of AIA Document A201. When the contractor prepares the list, the architect has the authority to add items to the list that the contractor may have overlooked. When inspecting the project to determine these two important milestones—substantial completion and final completion—the architect must look at the work with a much higher degree of care than that required during prior site visits, when the architect was only required to determine, in general, whether the work was proceeding in accordance with the contract requirements. Architects should generally avoid the term *inspection* to describe the architect's services. The Owner-Architect Agreement makes an exception in Paragraph 2.6.6 with regard to inspections for substantial and final completion.

Cleaning Up

The AIA General Conditions (Document A201) requires the contractor to keep the premises neat and orderly. Subparagraph 3.15.1 states:

> *The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials.*

The architect may add to these requirements by provisions in the supplementary conditions or in Division One of the specifications. It is common practice to require the contractor to clean and polish all glass, to wax tile floors, to vacuum carpets, and to leave other spaces "broom clean."

Subparagraph 3.15.2 gives the owner the right to clean the premises if the contractor fails to meet his obligations by stating:

> *If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and Owner shall be entitled to reimbursement from the Contractor.*

Paragraph 2.4 relates to the owner's right to carry out the work. If the owner chooses to exercise this right, the contractor must be given written notice. If the contractor fails to respond to the owner's notice, the owner can proceed to have the work performed by others. The owner must issue a change order to deduct from the contract amount the cost of such work performed by others. If the owner decides to have the work done by others because the contractor is not performing the work properly, the owner's actions and the amount to be charged to the contractor are both subject to the prior approval of the architect.

The General Conditions give the owner this right because the owner should not be constrained by the contractor's failure to carry out the work properly or to keep the premises reasonably clean and orderly. If the architect believes the contractor is not meeting his responsibilities to keep the premises clean, or has failed to clean up properly at the

completion of the work, he or she can recommend to the owner that another party be hired to clean up.

Occupancy by the Owner

The owner is entitled to occupy the project when the work, or designated portions thereof, are substantially complete. Substantial completion, as noted previously, requires that the work be sufficiently complete so that the owner can *occupy or utilize the Work for its intended use.*

On occasion, the work may be sufficiently complete to permit owner occupancy, but the owner does not choose to move in. If this occurs, the architect may be required to make an independent judgment that the work is substantially complete, entitling the contractor to the release or a reduction of retainage, and to shift to the owner responsibilities for insurance, warranties, utilities, maintenance, and so forth. Conversely, the owner may choose to occupy the project *before* the contractor reaches substantial completion. In this case, the contract may claim added costs and/or delays caused by the owner's interference.

The owner's personnel, equipment, furniture, and security requirements may further impede the contractor's operations. The architect may be required to evaluate the validity of the contractor's claim. The AIA General Conditions does not provide for situations where the owner either refuses to take occupancy at substantial completion or desires to move in prematurely. In either case, the architect must try to get the owner and contractor to identify in writing the consequence of their decisions so that each party's legal rights under the contract can be protected.

Release of Liens

Final payment to the contractor is conditioned on the contractor giving the owner a release of liens from the contractor and all subcontractors and material suppliers. Mechanics' liens are covered in detail in Lesson 10. At project completion, the AIA General Conditions requires the contractor to give the owner an affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the work have been paid. The contractor also is required to give the owner releases of lien in whatever form the owner may require. If the contractor is unable to get a release of lien from a subcontractor, the contractor can furnish a bond to the owner to indemnify the owner in the event a lien is filed. Because lien-related matters have serious legal consequences and can adversely affect the owner's title to the property, the owner's attorney must become involved in the event that liens are, or may be, asserted against the property.

As part of closing out the project, the architect usually receives from the contractor the Contractor's Affidavit of Payment of Debts and Claims, AIA Document G706 and Contractor's Affidavit of Release of Liens, AIA Document G706A. These forms should be forwarded to the owner for review by the owner's legal counsel. Neither the Owner-Architect Agreement nor the General Conditions requires the architect to make an independent evaluation of these documents. The architect, however, should not issue the final certificate for payment to the owner if he or she has any reason to believe that these documents are not in order, or if the owner, or the owner's attorney, informs the architect that the affidavits or releases of lien are not proper. Final payment to the contractor should be withheld until all such problems are resolved.

If the owner does not require the contractor to furnish a performance bond or a labor and material payment bond, it is even more important to make sure that releases of lien are in order before issuing the final certificate

for payment and closing out the project. Without bonds, the assertion of liens can cloud the owner's title to the property, as well as cause the owner to pay twice for the work if the contractor has not disbursed funds received from the owner to the subcontractors and suppliers. In many states, if the contractor goes bankrupt, subcontractors and suppliers to whom the contractor owes money can place a lien on the property and can require the owner to pay them directly, even if the owner has already paid the contractor for the work.

PROBLEM AREAS

Establishing the Contract Requirements

The construction process can be fraught with problems. An important part of the challenge of being an architect is to deal successfully with these problems. In fact, most problems do get resolved to everyone's satisfaction, and relatively few end up in litigation or as formal legal claims. Whether problems are resolved successfully often is directly related to how well the parties to a construction project understand their contractual and other legal obligations.

A construction contract is intended to be a detailed statement of the obligations of the owner and contractor with regard to each other and the project. If the contract, including the owner-contractor agreement, the contract conditions, the drawings, the specifications, and any modifications, is comprehensive and clear, there should be few questions about the rights, duties, and obligations of the contractor to perform the work and the owner to pay for it. Likewise, the role of the architect as the owner's agent during construction should be clearly stated. If problems arise, such as the contractor failing to perform the work in accordance with the contract documents, or the owner not paying for it as required by the contract, the contract should provide guidance for resolving the problems.

From the architect's standpoint, knowledge about the requirements of the contract documents goes beyond the technical content of the drawings and specifications. The architect must also be familiar with the owner-contractor agreement and the general and supplementary conditions of the contract. Problem resolution begins with measuring the facts associated with the problem against contract requirements. Guessing or making uninformed responses magnifies problems rather than solving them.

The AIA General Conditions (Document A201) requires both the owner and the contractor to ask the architect for an initial determination when disputes arise. Subparagraphs 15.1.1 and 15.2.1 state:

> *15.1.1 Definition. A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim.*
>
> *15.2.1 Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision*

Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

The legal concepts behind the architect's role as the initial decision maker are covered in Lesson 9. The technical aspects of that role require the architect to take the time to study the contract documents carefully before making a determination. The architect has to step away from his or her role as the preparer of the drawings and specifications and look objectively at those documents and any applicable provisions in the agreement and general and supplementary conditions. After the architect has reviewed the contract documents, he or she is then in a position to analyze the problem presented by the owner or contractor, or both.

When the architect gives a written determination about the problem, it is often helpful to cite the applicable provisions of the contract documents so that the parties can clearly understand the basis for the architect's determination. If the determination is adverse to a party's interests, that party will be less likely to conclude that the architect acted out of bias or self-interest if the architect has reinforced his or her findings with a statement of the requirements of the contract.

Documenting Problems

Factual Information

The most difficult task in analyzing problem areas often is gathering sufficient factual information to enable a proper evaluation to be made in a timely manner. It is imperative that conclusions not be drawn until the architect is satisfied that there is sufficient information available to make valid judgments.

Testing

If the architect suspects that the cause of a problem is noncompliance with the requirements of the contract documents, the architect can order work to be tested. Special testing not called for in the construction contract as part of the work requires written authorization from the owner. If the work subjected to special testing is found to be in compliance with contract requirements, the owner has to pay for the test, as well as for any remedial work to restore the work to its pre-test condition. Conversely, if the test reveals that the work does not comply with contract requirements, the contractor has to pay all related costs, including testing.

If tests are required, the architect establishes the standards applicable to the tests and how the results are to be measured. The architect may rely on industry-wide standards, such as those developed by ASTM, or he or she can establish special standards for unique project requirements. The latter is often the case when the architect determines that the project requires a higher standard than is normally accepted in the industry.

If testing is required, it usually is performed by an independent organization under direct contract to the owner or the contractor. Testing laboratories and companies must be free from any conflict of interest because their work can affect the safety and long-term viability of the project. The architect should not perform tests with her own employees or consultants because of the potential liability.

Causes

The causes of problems can be difficult to determine. Often, when a problem arises, responsibility is quickly assigned before all relevant facts are known or analyzed. The analysis of construction problems should be done carefully, much as the design was developed initially. Problem analysis involves research, investigation, documentation, review,

and reporting. The reporting usually takes the form of a written document instead of drawings and specifications. However, since construction moves at a rapid pace, and one decision can affect many aspects of the work, the architect must act expeditiously in making a determination. Paragraph 15.2 of the AIA General Conditions establishes time limits on the architect's response.

Design

When the construction of a building appears to be deficient, the design is often cited as the cause of the problem. The project design is a convenient target for several reasons. First, it provides the only record of what was intended to go into the project. The drawings and specifications are readily available to be analyzed. What actually went into the construction may not be easy to determine. For example, it may be impossible, after a structural collapse, to determine whether the contractor properly placed the reinforcing steel before the concrete was poured. Secondly, after problems arise, it may be convenient to say that a different or better design could have avoided the problem. When analyzing a problem, the real issue is not whether the design could have been done differently, but whether the design was appropriate for the project requirements and in accordance with the architect's duties to the owner.

When problems arise, care must be taken not to conclude prematurely that a faulty design caused the problem. There may have been intervening causes. For example, an underdesigned structural system might have collapsed, not because of the underdesign, but because of severe overloading by the contractor that would have caused a collapse regardless of the design. A curtain wall may appear to have leaked, not because of faulty detailing or quality of construction, but because the owner's employees did not close the windows during a heavy rainstorm. In every case, careful investigation is required before conclusions can be drawn.

For the architect to be liable for faulty design, it must be shown that the architect had a *duty* in regard to that aspect of the design in the first place. The architect would not be liable for a failure to properly design the structural system if, for example, the owner retained the architect merely to sketch a floor plan. Likewise, the architect would not be liable for the malfunctioning of an elevator system if the owner contracted directly with an elevator manufacturer for the design of the system. If the architect had a duty in regard to the design of the part of the project under investigation, the next step would be to determine if the architect had exercised reasonable care. Was there adequate investigation? Did the architect have the background and experience to proceed? Should she have utilized consultants? What were the constraints imposed by the owner and the budget? What were the trade-offs and options considered? All of these factors bear on whether the architect used *reasonable care* in reaching the design decisions that led to the actual design.

The law does not hold an architect liable simply because a design does not work or because it could have been executed differently and avoided the problem. After a problem arises, most architects would probably admit that they might have done things differently had they known of the potential problems beforehand. The test of liability is whether the architect was *negligent* in proceeding with the design. Did the architect fail to meet the ordinary *standard of care* when she performed the services? The fact that the design does not work is not conclusive in establishing the architect's liability. Therefore, any analysis of a construction problem that focuses on the design must be weighed against the legal standards applicable to design liability.

Construction

If the design and the contract documents have been prepared properly, the contractor is expected to construct the project in accordance with the contract documents. A failure by the contractor to do so is a breach of the contract with the owner.

Any analysis of construction-related problems must begin by establishing what the contract documents require. The contractor's performance must be measured against contract requirements. Once they have been determined, the investigation can focus on the work performed by the contractor and how it deviated, if at all, from the contract requirements. Unlike an analysis of the design that can involve many subjective factors, the evaluation of the contractor's work usually can be measured objectively against the standards established by the contract documents.

Field investigations can involve photographing the failed portions of the work, installing gauges to measure deflections, taking concrete core samples to test for compressive strength, cutting samples from the roofing material to analyze chemical composition, and various other technical evaluations. In each instance, the investigation must be carefully documented, including who performed the test, the date of the test, weather conditions, and other relevant factors. Photographs must be dated and the photographer identified. These precautions are necessary so that the investigation results can be used as evidence in litigation.

Maintenance

Problems can arise with a completed project if the owner or occupant fails to properly maintain it. Maintenance can involve such things as keeping metal roofs painted and changing filters on HVAC equipment. All buildings have ongoing maintenance requirements, and it is the owner's responsibility to see that maintenance is carried out on a proper schedule. The architect should alert the owner at the end of the construction phase about those aspects of the project for which there are special maintenance requirements. Paragraph 9.8 of the AIA General Conditions shifts the responsibility for maintenance from the contractor to the owner on the date of substantial completion.

If the architect is called back to the project because of a problem caused by a lack of proper maintenance, the architect should be prepared to recommend to the owner both corrective work to remedy the immediate problem as well as what can be done to prevent recurrences in the future. Services provided after the completion of construction are considered additional services according to Article 3 of the Owner-Architect Agreement.

If the problem is design-related, an architect might not seek additional compensation for the services required to deal with the problem because of the potential for alienating the client. An architect has to use good judgment in responding to a client's notification about problems with the project so that the owner and architect can work as a team to solve the problems.

Other Problem Areas

In addition to design deficiencies, poor construction quality, failures to adhere to contract requirements, and improper or inadequate maintenance, other problems may occur after the project is complete. Theses include normal wear and tear, extraordinary weather conditions, and unanticipated changes in usage. Whatever the apparent cause of problems, the architect must approach the investigation of the problem with a high degree of professionalism and objectivity. This is particularly true when the architect is requested to investigate problems on a project designed by another architect.

In this situation, the architect is performing the role of *expert witness*. The architect must gather all available facts, retain objectivity when analyzing the facts, and know the proper standard against which to measure the circumstances under investigation. Having done so, the architect will have fulfilled her obligations to the client, as well as to the profession, regardless of the outcome.

LESSON 4 QUIZ

1. Which AIA document requires that the architect maintain project files?

   A. Owner-Architect Agreement
   B. General Conditions
   C. Project Data
   D. None of the above

2. Which three of the following are important administrative tasks of the architect? Check all that apply.

   A. Processing of shop drawings and samples
   B. Evaluation and preparation of change orders
   C. Coordinating the work of contractors and subcontractors
   D. Certifying payment applications

3. A Project Representative is selected, employed, and directed by the

   A. architect.
   B. owner.
   C. contractor.
   D. clerk of the works.

4. A clerk of the works is generally employed by the

   A. architect.
   B. owner.
   C. contractor.
   D. project representative.

5. Nothing from the project file should be thrown away until

   A. a reasonable period of time after the completion of construction.
   B. two years have passed.
   C. the expiration of the statute of limitations.
   D. the bonding company gives its approval.

6. Record drawings noting the exact location of construction elements in a set of drawings when a change is made are the responsibility of the _____.

7. The architect's duties and responsibilities in connection with manufacturers' warranties are limited to which of the following?

   A. Forwarding the documents from the contractor to the owner
   B. Verifying that the warranties are legally sufficient
   C. Furnishing evidence to the owner that the kind and quality of materials and equipment are satisfactory
   D. Negotiating with the manufacturer in the event that the work is not of good quality or is defective

8. A contractor is obligated to leave a project "broom clean," but fails to do so. What should the architect do?

   A. Hire a professional cleaning firm and charge its fee to the contractor
   B. Have the owner issue a change order to have the work performed by others
   C. Stop work, thus stopping final payment
   D. Nothing

9. If a contractor is unable to get a release of lien from a subcontractor, the contractor can

   A. deduct the amount from the owner's final payment.

   B. have the architect negotiate a settlement with the subcontractor.

   C. draw upon the performance bond.

   D. furnish a new bond to the owner to indemnify the owner.

10. If an owner feels that a project is not progressing fast enough, he or she should

   A. ask the contractor for an explanation.

   B. ask the architect to request an explanation from the contractor.

   C. bring in an independent management consultant.

   D. fire the contractor.

11. Work that was subjected to special testing at the request of the architect is found to be in compliance with the contract requirements. Who must pay for the test?

   A. The architect

   B. The contractor

   C. The owner

   D. The testing company

12. If special testing is required, which is not called for in the construction documents, who establishes the standards applicable to the tests?

   A. The architect

   B. The owner

   C. An independent testing agency

   D. The engineer responsible for the work in question

13. An affirmative answer to which of the following questions could render an architect liable?

   I. Did the architect fail to meet the ordinary standard of care when he or she performed services?

   II. Does the design work poorly?

   III. Could the design have been executed differently and the problem avoided?

   IV. Did the architect lack care in designing a defective component or system, which was constructed or manufactured in accordance with that design?

   A. I only
   B. III only
   C. II, III, and IV
   D. I and IV

14. Documentation for a construction field investigation should include all of the following, EXCEPT

   A. who performed the test.

   B. the date of the test.

   C. the architect's role in supervising the work in question.

   D. weather conditions.

15. Whose responsibility is it to see that maintenance is carried out on a proper schedule after substantial completion?

   A. The owner
   B. The architect
   C. The subcontractor
   D. The manufacturer

LESSON FIVE

DELIVERY METHODS

5

OWNER REQUIREMENTS

The method of delivering design and construction services is typically based upon an owner's needs and capabilities. A small organization, a small firm, or an individual that wishes to develop a project would typically require full professional design services from an architect and a traditional design/award/build delivery process. An owner who desires to participate in the design process would likely select this traditional method, ensuring that the final project meets all of the owner's criteria. The design/award/build delivery method allows for all design decisions to be made before contracting with a builder.

A large organization or firm that wishes to develop a project may have an in-house staff that has capabilities for project programming, design, engineering, facilities management, construction management, or construction. Such a firm may not require the traditional design/award/build delivery method. An owner also might have certain time frame and/or cost considerations that would require other types of delivery methods. An owner who has a commitment to deliver a project for occupancy in a short time frame may not be able to take the amount of time required of the traditional design/award/build process. Such firms may require other project delivery methods, which typically consist of either the construction management or design/build methods.

DESIGN/AWARD/BUILD DELIVERY METHOD

The design/award/build delivery method typically begins when an owner hires an architect to develop a project program and its subsequent design and construction documents. Bidding of the project to several contractors occurs after all construction documents and specifications have been completed. This allows for the establishment of the lowest reasonable cost for the project. The owner then awards a single prime construction contract to a general contractor to build the project based upon the completed design documents. The architect acts as the owner's agent, representing the owner's interests throughout the design and documentation phases. The architect's services typically include construction administration services. The architect then acts as an impartial interpreter of the construction documents during construction.

The benefits of the design/award/build delivery process include owner participation in the design of the project and well-established construction costs based upon relatively complete documents. The architect acts in the owner's best interests during design, and the architect acts as an impartial interpreter of the contract documents during construction. This process allows for clear separation of design and construction responsibilities, and allows for simplicity in project scheduling since each phase of the design and construction process is separate.

The design/award/build delivery process, however, requires an extended time period for design and documentation before final costs can be determined and construction can begin. This is a problem if an owner wishes to expedite a project. Also, pricing and constructability experience of the contractor who is to build the project is not available during the design and documentation phases of the project.

CONSTRUCTION MANAGEMENT DELIVERY METHOD

The construction management delivery method allows an owner to address constructability and cost issues during design. An owner can also address time issues by utilizing fast-track construction, in which multiple construction contracts are let for different parts of a project as soon as each part of the work is defined enough for a contractor to reasonably commit to a price. In this delivery method, the owner hires or utilizes his or her own construction manager to work with an architect to facilitate the process of design, bidding, and letting of the construction contracts. The construction manager can act as either an advisor to the owner, or as a construction contractor. The construction manager typically has substantial expertise in construction technology, constructability issues, construction scheduling, and construction costs.

A construction manager who acts as an advisor administers the design contracts and works as the owner's representative with the design team. He or she also manages the various construction contracts, but does not have any financial responsibility for the construction of the project. A construction manager may, however, handle some of the typical non-construction activities at the site, such as arranging temporary site facilities, site and construction testing, engineering, building and site layout, and construction site cleaning. Some architecture firms offer construction management services, acting in an advisory role to the owner.

A construction manager who acts as a contractor assumes a vendor relationship with the owner. This person or firm will take on the financial responsibility for the construction of the project, typically utilizing a fixed-price, cost-plus, or guaranteed maximum price cost structure. The construction manager is brought onto the project before design work is complete so that he or she can help resolve constructability and cost issues.

A fixed-price structure allows the manager to establish a guaranteed cost of construction, including his or her own services, before the design is fully documented. The owner is not liable for bid-cost overruns. However, the owner does not obtain any of the savings that might occur from a positive bid climate. A cost-plus structure allows the construction manager to charge the owner the actual construction costs of the project plus a negotiated fee that is agreed to before construction begins. The actual costs are typically determined by the lowest bids received from the manager's subcontractors, plus the cost of any construction

work performed by the construction manager's own forces. The guaranteed maximum price structure is a highest-probable-cost limitation for the construction of the project guaranteed by the construction manager. This price is established before design documents are completed, and anticipates the full scope of work and detailing needed to complete the project. Any cost savings from a positive bid climate go to the owner rather than the contractor. However, the contractor becomes responsible for any bid-costs over the guaranteed maximum price.

The advantage of using the construction management delivery method is the ability of the owner to determine the costs of a project before construction documents are complete. The ability to let portions of the work for bid before other portions of the design are complete allows for construction work to commence before all other project drawings are completed. This is a great advantage for an owner who has a short time frame to complete a project due to occupancy requirements or when an owner has to work with high interest rates, which can add substantially to the financing costs of a project. Another benefit of this method is the ability of the construction manager to resolve technological or constructability issues before construction begins, which helps reduce costs due to construction change orders.

The construction management delivery method, however, adds a cost for the construction manager that an owner would not have in the more common design/award/build process. The addition of a construction manager adds complexity to the design and construction team. This can be a benefit if the relationships are managed effectively, but can become problematic if these relationships are not adequately defined and handled. The use of the fast-track construction method also adds to the complexity of the project, requiring the management of multiple bidding periods and multiple prime construction contracts.

DESIGN/BUILD DELIVERY METHOD

The design/build delivery method allows an owner to utilize a single entity that is responsible for both the design and construction of a project. This is the single greatest distinction between this method and both the design/award/build and the construction management methods. A design/build firm can be a single company that has its own architectural and construction staffs, or a company that has its own construction staff that hires an architect to perform design services. A development firm can hire an architect for design services and a contractor for construction services. A design/build firm can also be a joint venture between an architect, construction, and/or a developer.

An owner who wishes to proceed with the design/build process typically issues a request for proposals to selected design/build firms that state the design and performance requirements for the project. The design/build entities submit proposals to the owner that provide a design for the project and the costs for the design development and construction of the project. The selected design/build firm then develops the design, provides construction documents, and builds the project based upon the proposal requirements.

An owner who wishes to have more control over the design of the building can have an architect develop the schematic concept for the project. This can then become part of the request for proposals, which makes the selected design/build firm responsible for the development of the design, the construction documents, and the building of the project.

The advantages to the design/build delivery method include a single source of responsibility for both design and construction of the project, allowing the owner to select from a number of submitted designs. A reliable cost for the project is determined early in the process, and conflicts between the designers and the builders are minimized. This process also facilitates fast-track construction, since the portions of the design work that can be built early can be released for construction before the balance of the design and documentation work is complete.

This delivery method, however, minimizes the ability of the owner to participate in the design of the project. The design/build firm acts solely as a vendor so that the owner does not have an independent agent working for his or her interests. This requires the owner to be adept at managing the design/build contract through construction, or to hire an independent firm to act on his or her behalf. Any design changes would likely require a change order that the owner would have to pay. Since the submitted designs are likely based upon incomplete drawings, disputes may arise regarding the actual scope of work provided in the proposal. Also, a selection that is based solely on the lowest bid may have significant quality issues that would be difficult to address.

SUMMARY

Architects need to be well acquainted with different project delivery methods, from the possible liability issues they present to the extent to which the process may compromise the execution of the intended product. Candidates should be familiar with the different methods and their benefits and drawbacks as they apply to different types and sizes of projects.

LESSON 5 QUIZ

1. Which delivery method involves an owner hiring someone with constructability and cost expertise to work with the architect during the design phase?

   A. Design/build

   B. Design/award/build

   C. Joint venture

   D. Construction management

2. Which of the following is not an advantage of the typical design/build delivery method?

   A. Facilitates fast-track construction

   B. Provides a reliable project cost early in the process

   C. The owner participates fully in the design process

   D. The design/build firm provides a single source of responsibility for design and construction

3. An architect acts as an owner's agent in which of the following situations?

   I. As a member of a joint venture with a construction company

   II. The design-award-build delivery method

   III. The construction management delivery method

   IV. The design/build delivery method

   A. I and III

   B. II and IV

   C. II and III

   D. I and IV

LESSON SIX

SCHEDULING OF DESIGN AND CONSTRUCTION

ARCHITECTURAL PROCESS

After the planning process has been concluded, and the site has been selected, the architectural team will begin to focus on the project, including the project's buildings and related infrastructure.

Traditionally, the architect is faced with four components to every design decision:

1. Cost
2. Function
3. Time
4. Aesthetics

The new, sustainable ecological paradigm adds one additional component to form a pentagon of concerns:

5. Sustainability

The ingredients of the normal process have been discussed previously, but the new ingredient, sustainability, changes the meaning of all these pieces of this architectural process.

1. Cost

As architects put together budgets for their clients, they are always concerned with the first costs of the design components—the initial cost to purchase and install the design element.

Sustainable design has made the economic decision process more holistic. The decision to select a design element (such as a window, door, flooring, exterior cladding, or mechanical system) is now concerned with the "life-cycle" cost of the design.

1.1 Life-Cycle Costing

Life-cycle costing is concerned not only with the first cost but the operating, maintenance, periodic replacement, and residual value of the design element.

For example, two light fixtures (A and B) might have different first cost: Fixture A has a 10% more expensive first cost than Fixture B. When the cost of operation (the lamps use far less energy per lumen output) and the cost of replacement (the bulbs of Fixture A last 50% longer than the bulbs of Fixture B) is evaluated, Fixture A has a far better life-cycle cost and should be selected.

In this kind of comparison, the life-cycle cost may be persuasive; the extra cost of Fixture A may be recovered in less than two years due to more efficient operation and replacement savings.

In this situation the architect justified Fixture A to the owner, who benefits from more energy efficient lighting that continues to save the owner operating costs for the life of the building.

1.2 Matrix Costing

While designing a typical project, the architect faces numerous alternate decisions, a process that may be both intriguing and complex.

In nearly all projects, there is an established budget and program (including all the owner's functional requirements). The architect must balance the functional issues with the budgetary and aesthetic issues.

Sustainable design adds an ingredient to this matrix of decisions that may actually help the composition.

For example, decisions that allow the improved efficiency of the building envelope, light fixtures, and equipment may permit the architect to allow the engineer to reduce the size of the HVAC system, resulting in a budgetary trade-off. The extra cost of the improved envelope may be economically balanced by the diminished cost of the mechanical system.

This type of economic analysis, which evaluates cost elements in a broad matrix of interaction, is a very valuable architectural skill. The ability to understand the interaction between different building systems in a creative and organized fashion can differentiate an excellent architectural design from a simply adequate one.

2. Function

Functionality is one of the primary standards of architectural design. If the building doesn't perform according to the client's needs, then the building design has failed.

Sustainability adds a facet to functionality that even the owner may not initially appreciate.

As previously mentioned, life-cycle costing will affect the decisions in which elements are finally selected to form the final design. However, the search for sustainability may increase the dimensions of functionality.

Years ago, the design element could perform at the highest level regardless of its impact on the environment or energy use.

The fact that many industrial and residential buildings are operating much more efficiently now than in 1960 is evidence that the building design and construction profession is learning how to tune buildings to a higher degree of energy operation. But, with diminishing natural resources and increasing pollution of the environment, even more efficient design is necessary.

Today, architects will include sustainability in the selection of optimal functional design components.

For example, a roof system must be able to withstand a variety of weather conditions, be warranted to be durable a minimum of years, be able to be applied in a range of weather conditions, and have a surface with reflectivity that does not add to the urban heat effect.

3. Time

The schedule of a project is always a difficult reality of the design process. Time is a constraint that forces a systematic and progressive evaluation of the design components.

The sustainable component of the architectural process may add to the amount of time the architect will spend on the research for the project.

The architect may spend more time on a sustainable design with the result being a more integrated, sustainable project.

4. Aesthetics

The aesthetic of a project is the combination of the artistry of the architect and the requirements of the project.

Sustainable design has the reputation of emphasizing function and cost over beauty and appeal.

It is the architect's responsibility to keep all the design tools in balance. A project without aesthetic consideration will fail the client, its user, and the potential client that may be deciding between the normal design process and one that considers a broader, integrated, sustainable approach.

5. Sustainability

The fifth point in the calculus of the architect is a new component that leads to a new, holistic evaluation of the design process. Because a piece of any living element must be part of the cycle of nature in order to survive, all manmade elements should now consider the mantra, "do no harm and be designed to be integrated within the cycle of all living things."

Architectural designs should create by-products that can be recycled with other natural elements and not cause depletion of natural resources necessary for the health of future generations.

Sustainable designs should have four goals:

1. Designs that use less
2. Designs that recycle components
3. Designs that have components that are easily recyclable
4. Designs that have components that are fully biodegradable

DESIGN SCHEDULING

Establishing a Schedule

In furnishing professional services, an architect must prepare a time schedule that encompasses all phases of production, from initial conceptual planning to the start of construction. The architect must plan the judicious and efficient use of manpower and resources to achieve an economical, functional, and harmonious design, executed within a reasonable period of time, and with an efficient utilization of personnel. The managerial skills required for such planning and scheduling are based on experience and judgment.

To organize the schedule, the architect first separates the design effort into phases, which

generally correspond to phases of the AIA standard owner-architect agreements as follows:

1. *Schematic design*, consisting of schematic drawings and other documents that describe the general relationships and space requirements of the project, along with a cost estimate.
2. *Design development*, consisting of preliminary drawings, outline specifications, and other documents that describe the form, size, and materials of a project, and the structural, mechanical, and electrical systems to be utilized. A preliminary cost estimate is also prepared during this phase.
3. *Construction documents*, consisting of working drawings, final specifications, and a final cost estimate.
4. *Bidding or negotiation*, which includes the receipt and evaluation of bids or negotiated proposals. It may also include preparing addenda to the contract.
5. *Construction administration*, consisting of the services rendered by the architect after bidding or negotiation to ensure that the structure is built in accordance with the construction documents. In this phase the architect may issue change orders, approve shop drawings, choose or approve materials and colors, and issue payment approvals.

In complex projects, the five phases described may not be adequate. For example, schematic design may be divided into conceptual design and schematic design. Similarly, the construction documents phase may be organized into several subdivisions, so that work on one subdivision may be completed and bid before the next phase is begun.

The architect must estimate the time required for each phase of the work. The schematic design phase is the most difficult to estimate, since it has the greatest amount of variability. This phase of the work is usually done by a small design team, generally headed by a chief designer, and possibly including an engineer and other specialists. The design concept must be developed out of the skill and experience of the design team working closely with the client and each other. Among the factors affecting the time required for schematic design are:

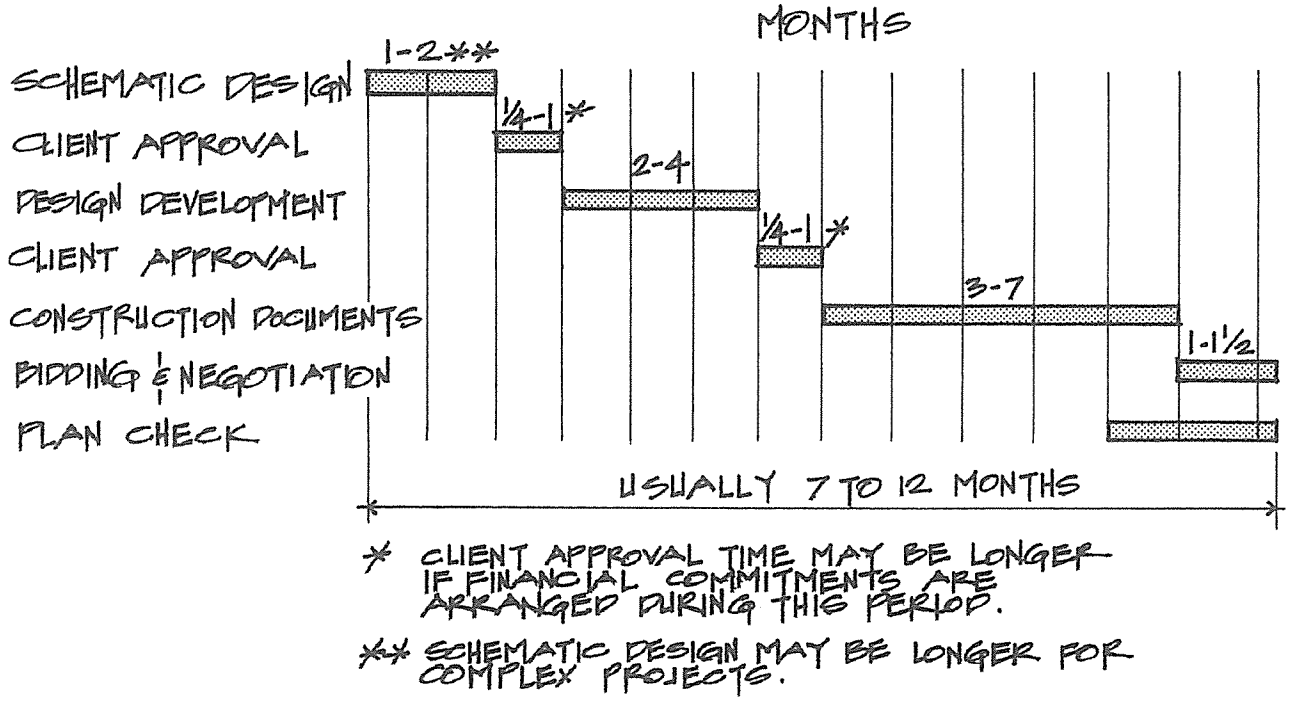
1. *The size and complexity of the project,* complexity generally being more critical than size.
2. *The quality and completeness of the program information supplied by the client.* If the architect does not have an adequate statement of the client's requirements—a conclusive program—then it will be necessary to prepare one, or to improve what exists. In contrast, an experienced client will often furnish the architect with a thorough and reliable catalog of needs, thereby enabling the architect to begin work immediately. Such a client may provide the architect with information such as project goals, area requirements, functional relationships, zoning information, a site survey, and a budget.
3. *The decision-making ability of the client.* If the client has a decisive representative who has the authority to make decisions, schematic design can proceed at a rapid pace. On the other hand, if decisions require committee approval, or if they cannot be made expeditiously, schematic design time will be prolonged, with consequent loss of momentum. If the client and architect do not have an effective communication system, the process is further delayed.
4. *The nature of the design team.* If the team is well balanced, if they work together harmoniously, if they are skilled and experienced, if they are able to work on the project without interruption, and if they

can communicate readily with the client, then schematic design time will be kept to a minimum.

These factors illustrate why it is difficult to plan a time schedule for schematic design. For a simple, conventional project, schematic design can often be completed in one or two months. It is not unusual, however, for the schematic design of a complex project to require 12 months or more.

The design development and construction documents phases of the work are much more predictable than schematic design, assuming schematic design has been thorough and there are no program changes. A team of architects and drafters, headed by a project architect and/or job captain, develops the schematic design into preliminary design drawings, which are then developed into working drawings. If the project is large in scope, staffing must be increased commensurately. The length of time required to produce these drawings may not be directly proportional to the size of the project. A $10,000,000 project, for example, may require only 50% more time than a $2,000,000 project. The complexity of a project, rather than its size, determines scheduling and staffing requirements. During the preliminary design and design development phases, close coordination between consultants, client, and designers is vital.

Design development for a typical project takes from two to four months; the construction documents phase may typically require from three to seven months. The bidding or negotiation phase usually requires three to six weeks, regardless of the size of the project.



BAR GRAPH FOR SCHEDULING OF DESIGN

Figure 6.1

A less obvious factor that may influence the work schedule is project financing. Whether the client is an individual, a partnership, a corporation, or a public agency, money is required to convert a design into reality. Private clients may borrow money from a bank, while a public agency may have to obtain a bond issue. The client may use the time between work phases to obtain a financial commitment and may, in some cases, postpone authorization to the architect to proceed with a successive phase until financing is secured. This may take weeks or months for a private client and even longer for a public agency.

Client review and approval is customary between phases, and the time required for this will depend on the size and complexity of the project, as well as the ability of the client to make decisions.

Some projects require more than one client approval, which may lengthen the review period. For example, many public school projects require the approval of a state department of education as well as a local school district. Client review and approval usually takes between one week and one month, unless complications arise.

The time required for approval of plans by a building department or other public agency varies considerably, depending on the locality and type of project. For example, a state hospital project, which may require approval by a state agency as well as the local building department, may require up to three months for plan checking. In localities where the checking of plans is less critical, a building permit may be obtained within a week.

Application for a building permit requires the filing of construction drawings and specifications; this is often done near the conclusion of the construction documents phase so that the building permit is obtained at about the same time the construction contract is let. This is not always the case, however. Sometimes the application for the building permit is not made until after the bidding period, while in other cases, the permit is obtained before the bidding phase. Whatever order is followed, the time required for plan approval should be considered by the architect in preparing the time schedule.

In completing the time schedule, the architect assembles all the time estimates into a bar graph, as shown on the previous page. The bar graph indicates ranges of time for each phase. In an actual project, however, a specific period of time would be assigned for each phase.

Contingencies

In organizing the architectural production schedule, the architect must consider the possibility of unexpected problems that may arise. There may be delays with the building department, consultants may need additional time because of unique problems inherent in the project, staffing problems may arise in the architect's office if the work load changes suddenly, or the client may be less decisive than expected. For these and other reasons, it is wise to include a contingency factor in the schedule. If the architect estimates the total required time to be eight months, an additional allowance of at least two to four weeks seems prudent.

The schedule should be flexible and responsive to changing conditions. For example, if the schematic design phase extends beyond its scheduled completion date, it should be possible to reduce the time allotted to design development and construction documents.

Working with a Builder

The preceding discussion assumes a conventional sequence of events in which the construction documents are completed before

bidding or negotiation begins. In recent years, however, closer methods of work coordination between the architect-engineer team and the builder have been developed. Many architects now work closely with a contractor from the conceptual phase through the completion of working drawings. A result of this cooperation is often a guarantee of maximum project cost, furnished to the owner by the contractor, upon completion of contract documents. This is referred to as a GMP—a "guaranteed maximum price."

Working closely with a builder has a significant effect on the architect's production schedule. More time must be given to schematic design if the architect is to produce a concept that the contractor considers economical. Design development, likewise, may take more time; however, construction documents will probably take the same time. Since the time during which the drawings are being prepared overlaps actual construction, overall project time is generally shortened. But there are risks in this procedure that the building design may not be fully developed or the components fully resolved.

Regardless of the procedure followed, the working drawings and specifications must be complete, clear, and correct. In some cases where the architect works closely with the contractor who will construct the project, the documents may be less specific, allowing the contractor leeway in procedures, details, and materials. This practice can be risky for both, and hence, should be restricted to common or repetitive projects. With close architect/builder cooperation, the bidding and negotiation phase may be omitted entirely, since these activities become a continuous process.

The total scheduled production time is usually similar to what it would be if the project were done conventionally. The architect's staff hours, however, may be greater because of the time spent coordinating with the contractor and possible redesigning. There are no short cuts; architectural projects require attention to detail, and invariably that takes time.

Extending the Schedule

All creative activity requires time, which should be enough to absorb information and develop ideas, but not so much that momentum and interest lag. For architectural design, an optimum work schedule is one in which the necessary work can be accomplished comfortably without expanding or shortening the schedule.

On a project with an extended schedule, principal team members may retire or take other positions before completion of the work. A recent state college project was delayed four years, between design development and construction documents, because of lack of funding. When the project resumed, the original project architect, mechanical and structural engineers, and key client personnel had made career changes. The resumption of work entailed starting over. The groundwork had to be reestablished, resulting in wasted time and effort.

One of the most significant effects of an extended design schedule is the increased cost due to inflation. In the recent past, inflation ran as high as 1% per month. At that rate, a $10,000,000 project which is delayed two months would cost the owner an additional $200,000. The additional cost resulting from the delay of a project may cause it to be terminated or reduced in scope. For example, in the case of the state college project mentioned above, the original project budget could not be increased during the four-year delay, and therefore the scope of the project had to be reduced by about one-third. The facility as finally built was smaller and of lower quality than it would have been without the four-year delay.

Shortening the Schedule

Clients often want their projects completed in as short a time as possible. During periods of inflation, there is additional pressure to shorten the design schedule. The purpose of any schedule, however, is to make optimum use of staff effort and resources. Therefore, to achieve significant reductions in time, one or more of the following methods must be employed:

1. The architectural team works overtime. While this saves time, it is costly and inefficient. A person working a ten-hour day over a long period of time cannot consistently produce 25% more work than someone working an eight-hour day.
2. Hire more people, bring in part-time or freelance staff, or subcontract work to another firm. All of these solutions are possible and will probably save time, but they are also costly and inefficient. New staff people will not be familiar with office procedures or the particular project, and their competence is unknown. Part-time people may be experienced and competent, but they are usually expensive. Subcontracting to another firm is feasible, but this is expensive, and coordination and supervision may be awkward.
3. Reduce the man-hours spent on the project. This generally results in a lower-quality job. Quality work requires adequate time to produce, and if that time is not available, an incomplete set of working drawings and specifications may result. Under these circumstances, one can expect documents that are incomplete, unclear, and likely to contain errors and inconsistencies. That, in turn, implies future problems, delays, and excessive change orders during construction.

Thus, the net effect of a reduced time schedule is likely to be a higher cost for design, a higher cost for construction, and a lower quality project. During periods of high inflation, an owner may be willing to tolerate a degree of increased costs with decreased quality, but this decision should be made only with the client's full appreciation of the consequences.

Methods of shortening both the design and construction schedule, simultaneously, will be described shortly.

CONSTRUCTION SCHEDULING

Establishing a Schedule

By their very nature, all construction projects are complicated, since they involve the work of numerous trades and subcontractors, all of which must be coordinated. Equipment must be utilized efficiently; materials must be ordered, stored, and used in a logical sequence; and accurate time schedules and costs must be recorded.

When a contractor prepares a construction schedule for a project, it is generally based on past experience. But no two projects are ever exactly alike, no two sites are the same, and therefore construction schedule estimates must be tempered with judgment. Contractors must consider a number of factors, including the following:

1. *The construction documents.* If these have been well prepared, relatively few problems or delays may be expected. Conversely, a poor set of working drawings or specifications will lead to disputes among the architect, contractor, and subcontractors. Such disputes consume considerable time and energy.
2. *The architect-engineer.* Some architects and engineers are extremely demanding regarding the interpretation of the contract

documents. Others are less demanding and more amenable to changes.

3. *The subcontractors.* The contractor must evaluate their ability to perform the work properly and on time, and to coordinate their work with others.
4. *The contractor's organization.* The skills of the project manager, field superintendent, and the office and field staffs must be considered in relation to the specific project. Some managers and superintendents are more capable of expediting the work than others. Also, the particular work load of the contractor will influence his ability to divert staff and equipment to and from the project under consideration.
5. *Material dealers.* The contractor must assess their reliability in meeting delivery schedules on time and correctly.
6. *The size and complexity of the project.* Complexity is one of the most critical elements in planning a construction schedule.
7. *Site conditions.* The size and accessibility of a construction site work area are critical factors in schedule planning. So is the condition of the site itself—its drainage, vegetation, subsoil, etc.
8. *The weather.* This is important, especially in the colder areas of the country, where projects may have to be shut down during snowstorms, heavy rainstorms, or periods of extreme cold.
9. *The possibility of labor troubles.*
10. *The possibility of material shortages* or delay in obtaining critical equipment.

The contractor must estimate the time required for each construction operation and the sequence of these operations in order to establish the schedule.

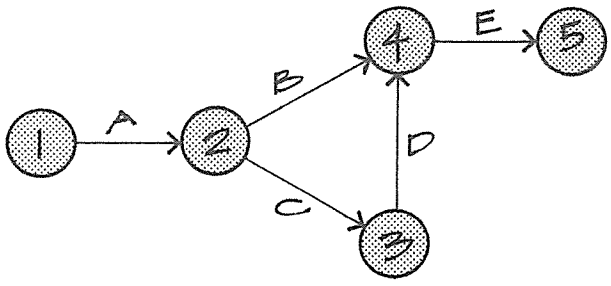
CPM (Critical Path Method)

The first step in developing a "critical path" is the planning phase, in which a diagram is drawn indicating the order in which the various operations comprising the project are to be accomplished. The project is divided into concise tasks called "activities," and these are represented by arrows on the CPM chart.

Each activity has a definite start and finish represented by circles, and referred to as "events" or "nodes." An "event" is defined as that moment when a preceding activity has been completed and the following activity may begin. Important points in the construction process, such as the roofing of a new building, are referred to as "milestone events."

In CPM planning there is no indication of time; the arrows are not drawn to a time scale. The tail of an arrow indicates the start of an activity and the head of an arrow, the finish, and each arrow is associated with a start and finish event. No new activity can be started until activities represented by all the previous arrows have been completed.

The completed CPM diagram is known as a *network diagram.* The network must be continuous, with no gaps or discontinuities.



NETWORK DIAGRAM

Figure 6.2

In the network diagram shown in Figure 6.2, activity A starts at event 1 and terminates at event 2. Activities B and C cannot start until A is completed. Activities B and C can proceed simultaneously; however, activity D cannot start until C is completed. Activity E, starting with event 4 and finishing with event 5, cannot start until both activities B and D are completed. The construction of a footing supported on drilled cast-in-place concrete piers will now be considered.

Excavation of earth, construction of footing forms, and procurement of reinforcing steel can all proceed independently of each other. Drilling of piers follows excavation. Pier steel cannot be set until after both drilling of piers and procurement of pier steel have been completed. Pouring the piers follows setting of pier steel. Footing forms are set after both pouring of piers and construction of footing forms have been completed. Setting footing steel proceeds after both setting footing forms and procurement of footing reinforcing steel are completed. Finally, pouring footing follows setting footing steel.

The network diagram for the work described in the previous paragraph is shown in Figure 6.3.

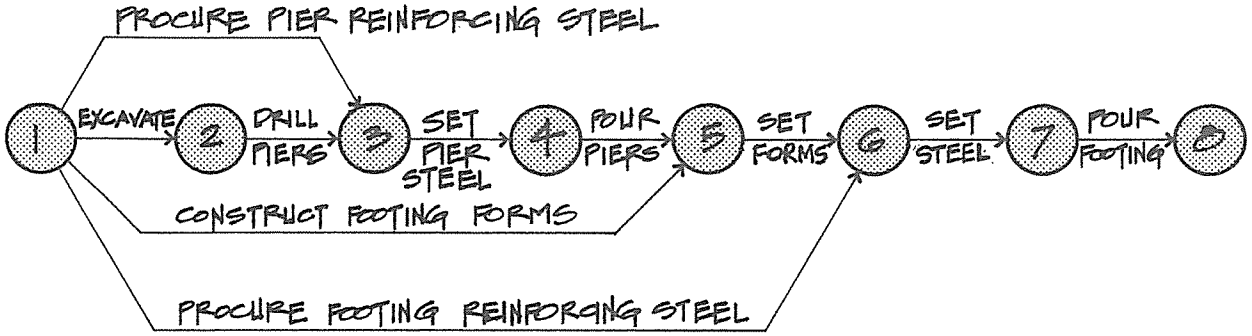
Note that each activity starts and finishes with an event, shown as a numbered circle, and that the end event always has a higher number than the starting event. Each event number occurs only once in the network.

While the pier-supported footing is a simple project, it serves to illustrate the value of CPM in job planning. The network is a model of the project, and its preparation requires the contractor to analyze the job logically from start to finish. The diagram communicates the job logic far better than any verbal description or bar graph.

Sometimes different portions of a project are planned separately, with separate network diagrams. For example, a project may consist of two buildings with connecting utilities. Events common to both networks are called *interface events*, and are usually shown as in Figure 6.4.

CPM Scheduling

After the project has been divided into concise activities and their logical sequence has been determined and charted in the network diagram, the time required for the project must be determined. Thus far, only the activities and



NETWORK DIAGRAM FOR PIER-SUPPORTED FOOTING

Figure 6.3

their relationships have been considered; now the element of time is applied to the chart.

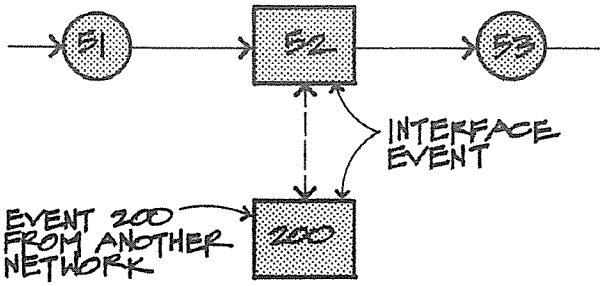


Figure 6.4

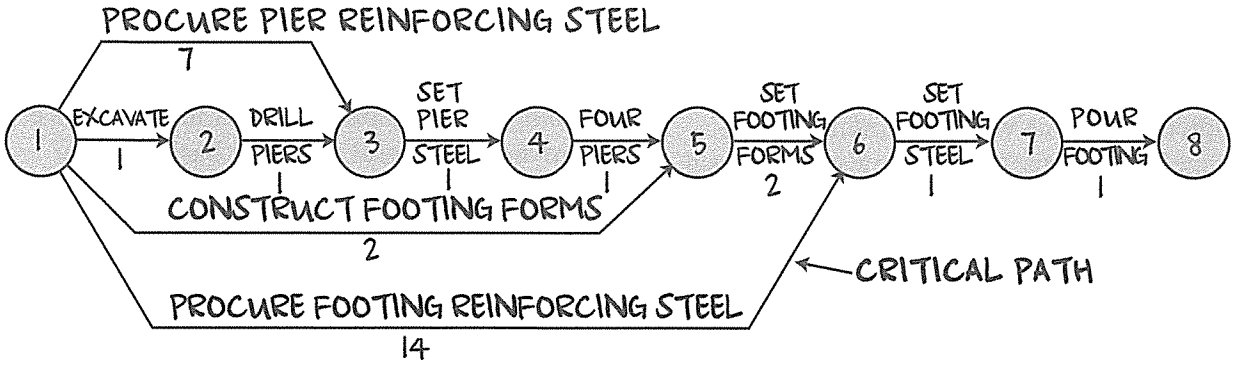
The contractor estimates the time required for each activity, based on past experience. A normal working day is taken as the unit of time. The assumption is made that materials and labor will be readily available, and that a normal level of labor and equipment will be utilized. Where subcontractors are involved, the contractor may consult with them regarding the time required to perform their specific activities. The estimated activity times in working days are now noted on the network diagram below each arrow. (See Figure 6.5.)

In preparing an accurate time estimate, the reliability of the subcontractors is critical. A general contractor, therefore, should be familiar with the subcontractors and their work, and consider only those who are pre-qualified or otherwise highly dependable.

Critical Path

The simple project illustrated in the network diagram includes several paths, from start to finish, and each has a varying total time duration. For example, path 1-2-3-4-5-6-7-8 requires a total time of 1 + 1 + 1 + 1 + 2 + 1 + 1 = 8 days. Path 1-5-6-7-8 requires 2 + 2 + 1 + 1 = 6 days. Since *each* path must be traversed to complete the project, the total project time is established by the path with the *longest* total required time. This is known as the critical path, and is generally shown as a heavy line. In the diagram below, the critical path is 1-6-7-8, with a total time of 14 + 1 + 1 = 16 days.

The activities along the critical path are called critical activities—in this case consisting of procuring reinforcing steel, setting footing steel, and pouring footings. If a critical activity is delayed, it will delay the completion of the project. These activities, therefore, must be carefully monitored during construction in order to keep the project on schedule.



NETWORK DIAGRAM FOR PIER SUPPORTED FOOTING SHOWING ACTIVITY TIMES & CRITICAL PATH

Figure 6.5

Float

All paths in the network diagram, other than the critical path, are called *float paths*. The float is the difference in time duration between the critical path and any other path. Path 1-2-3-4-5-6-7-8, which requires 8 days, has a float value of 8, since it is 8 days shorter than the critical path time of 16 days. Similarly, path 1-5-6-7-8, which requires 6 days, has a float value of 10. The float, then, is a measure of the extra time available for an activity or group of activities.

As long as float time is not exceeded, no delay in project completion time will result. The path 1-2-3-4-5-6-7-8, for example, which we have determined to have a float value of 8, can be delayed up to 8 days without delaying project completion. This delay can occur in one or more activities along the path, providing the total delay does not exceed 8 days. The delay may occur only in activities from 1 through 6, since 6-7 and 7-8 form part of the critical path.

Project Calendar

The contractor, having determined that the finish date of the project is 16 working days after its start, now converts this to calendar days by multiplying by 7/5, since there are five working days in each seven-day week. ($16 \times 7/5 = 22.4$, say 23 calendar days.) Knowing the project starting date, the contractor can calculate the completion date, as well as the start and finish dates of all activities. He now establishes a project calendar, indicating the scheduled starting and completion dates of all the activities within the project. Critical activities are noted in color or boldface, since any delay in the schedule of these activities will delay completion of the project.

If the job schedule has been prepared carefully and realistically, the field work will proceed at an efficient pace. If excessive time has been allowed for certain activities, a more relaxed pace may result, leading to increased labor and overhead costs.

There can be great variation in the duration of construction projects, depending on the factors mentioned previously. However, most building construction projects require from nine to eighteen months.

Contingencies

A realistic schedule should incorporate an allowance for project delays caused by weather or other unforeseen events. A reasonable allowance can be made for the number of working days expected to be lost because of weather, depending on the season and the activity. Obviously, it is impossible to be precise regarding potential delaying factors such as accidents or labor strikes. Some contractors add a fixed percentage to the total estimated time to allow for such possibilities, or they may incorporate contingency provisions in the construction contracts.

CPM Calculations

The example of a pier-supported footing describes a simple project; however, the same logic and scheduling technique is used on large and complex projects. CPM programming can be done at a simple level or a complex one. Computer programs designed for CPM have proven very useful, once the basic activity sequencing and activity times are known. CPM is an extremely helpful planning and management tool, and its use in construction planning and scheduling has become almost universal.

Bar Graphs

Bar graphs have long been used for planning and scheduling construction projects. They indicate the starting and finishing dates of major phases of the work and can be clearly

understood by all concerned. Their main disadvantage is that they do not indicate the relationship between the sequence of activities, or the dependency of an activity on the completion of a previous activity. The bar graph therefore is inferior to CPM as a management tool, but superior to CPM as a means of visual communication. Bar graphs, such as the one shown in Figure 6.6, continue to be widely used in construction.

Shortening the Schedule

There are a number of reasons why an owner may want the use of his building as quickly as possible. Among these are the demands of business, which is often the case for commercial or industrial facilities. Other reasons may be to minimize the effects of inflation, inclement weather, or the persistent costs of interest on borrowed construction funds.

The CPM method demonstrates that one of the most effective methods to save construction time is to reduce the critical path time. Although the activities on the critical path may amount to only 25 or 30% of all the project activities, reducing them reduces the whole construction schedule.

Shortening the durations of the critical activities will very likely increase direct cost, because inefficiency is increased through added overtime work. Increasing the number of workers is also inefficient because supervision and

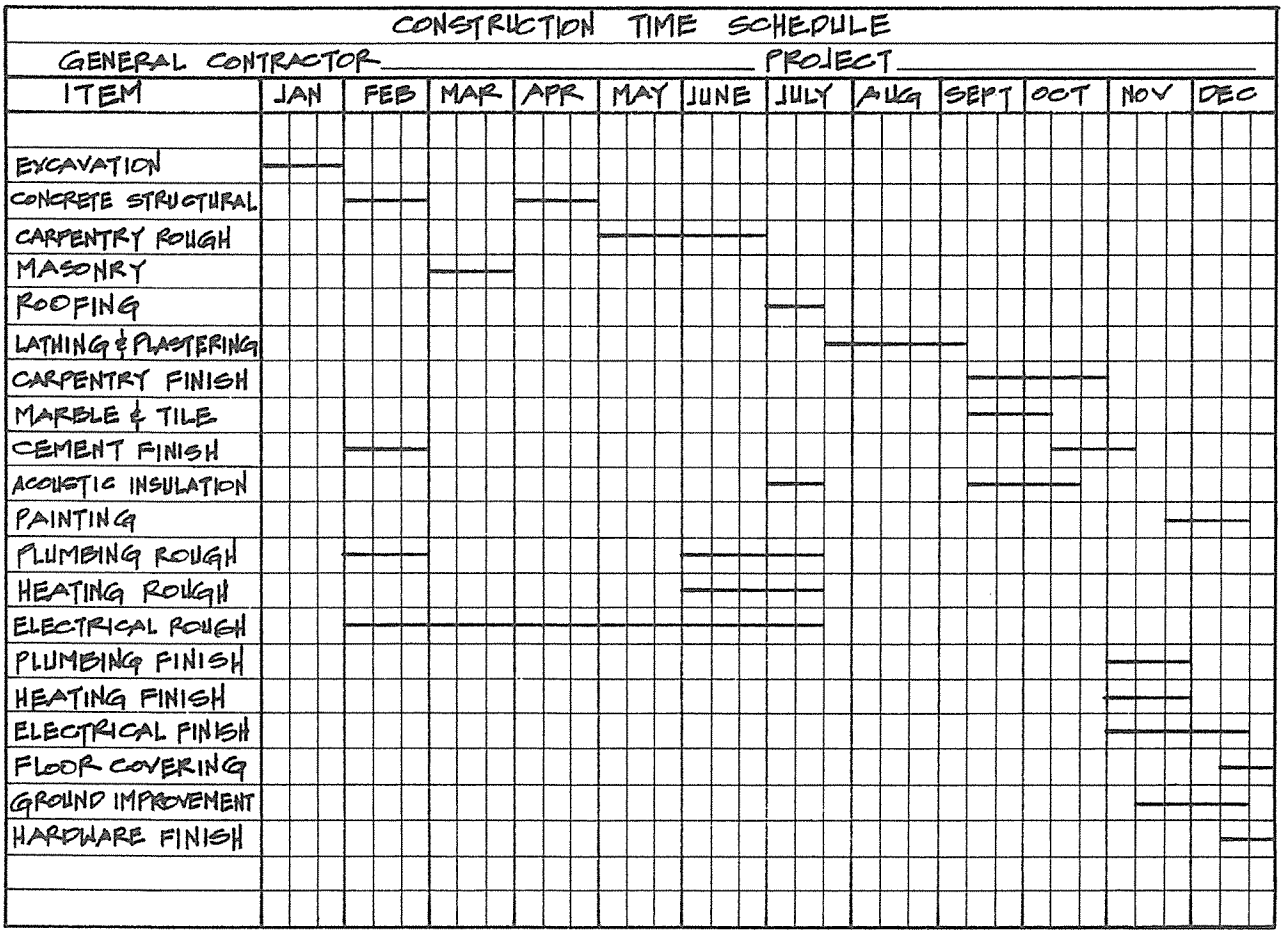


Figure 6.6

coordination become more difficult. In general, the contractor's direct costs increase as the schedule is compressed into a shorter-than-normal time.

On the other hand, the contractor's overhead decreases as the schedule time is shortened. Since the total project cost is the sum of direct costs and overhead, and their effects by shortening the schedule are opposite, a contractor may find it worthwhile to analyze their effects and determine a balance that represents the lowest total project cost. A computer can be highly useful in doing this for a complex job.

Maintaining quality control becomes more difficult as the schedule time is shortened. Errors are more likely to occur because of the increased difficulty of proper supervision. The highest project quality is achieved when the project schedule is normal, that is, neither extended nor shortened.

If it is necessary to shorten the project schedule, the CPM network diagram can be analyzed to determine if the job logic can be modified, or if certain activity durations can be condensed. Individual activity times can be expedited by adding man-hours and equipment, recognizing that this will result in higher direct costs and will place greater demands on supervision.

Fast-Track Scheduling

Shortening design and construction schedules generally results in higher design costs, higher construction costs, and reduced quality. However, by combining the architect/engineer's design schedule with the builder's construction schedule, it is possible to realize an overall saving of time in completing the entire project. This technique is known as "fast-track," "accelerated," or "telescoped" scheduling. In this procedure, the architect first determines the major building elements, such as the column spacing, foundation system, mechanical systems, etc., before the detailed arrangements are worked out. The architect then produces detailed working drawings for a portion of the work on which the contractor may begin construction—site work, utilities, foundations, or possibly framing. Meanwhile, further detailed architectural design continues so that the architect produces his work just slightly ahead of the construction crews.

This approach requires close coordination among architect, engineers, client, and contractors. Since the design concept of building elements is established very early, oversights must be expected, and the correction of errors is generally an integral part of fast-track scheduling. However, major design revisions are all but precluded, except at very great cost.

Fast-track scheduling usually requires staged bidding, in which the project is organized into a number of separate stages or contracts—as many as 20 or 30—that are awarded to different contractors at different times. Thus, it may not be possible to obtain a fixed price for the entire project in advance of construction, as with conventional contracting that employs one general contractor. However, to ensure some degree of cost and time control and establish responsibility, a construction manager (CM) may be used to supervise the construction process. Most contractors are able to function either as general contractors or construction managers.

Construction management may also be performed by architectural firms. But large and complex jobs are usually better served by those whose expertise is in the actual construction of buildings.

A comparison of conventional and fast-track scheduling for a $7,000,000 hospital is shown in Figure 6.7, indicating that the construction would be completed seven months earlier if fast-track scheduling were used.

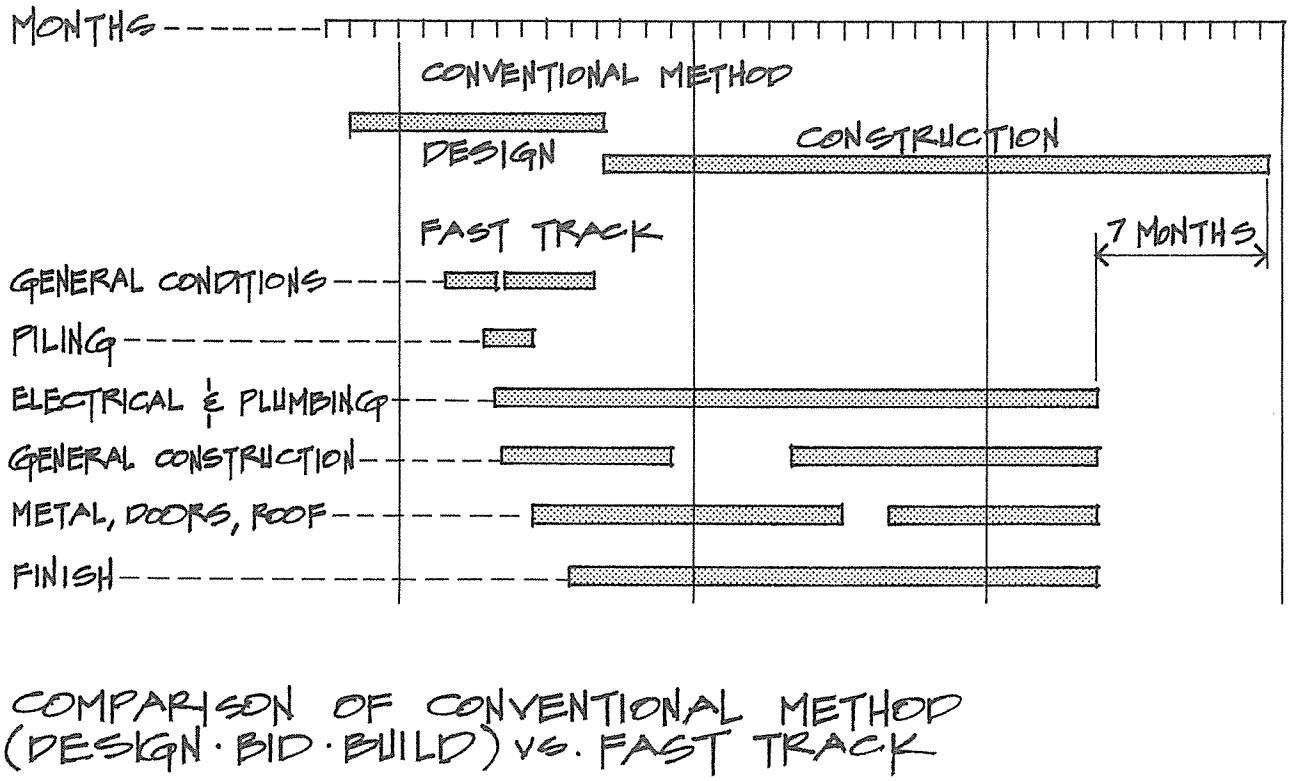


Figure 6.7

Some architects may find their roles expanded to that of developer, builder, or manager. Whatever the role, it will be essential for the architect to become familiar with new management techniques, since they will have an increasing influence over how future construction work is done.

TIME MANAGEMENT

Fabrication Time

Most products and components of assemblies or systems are specially fabricated for individual construction projects. Whether an item is prefabricated off-site or fabricated or constructed on-site may have an effect on a project's timely completion.

Architects may decide whether to select off-the-shelf, ready-made components, or to design and specify components fabricated in a shop for subsequent installation on-site. Custom designed and fabricated elements may have adverse effects on construction time, thereby favoring manufactured items. Manufactured or prefabricated elements provide many advantages. Design time is shortened, because it is faster to select standard products from a catalog than to custom design new ones. And manufacturers' shop drawings and other submittals are easier to review than those of specialty contractors. Prefabricating elements in a shop reduces the impact of inclement weather on construction time. Work can be performed during winter, rainy days, and even nights if necessary. All of these factors save time.

Other aspects of construction may be shifted from field to shop, as well. For example, metal-framed panels with brick facing may be mass-produced in a shop and erected on-site, instead of laboriously constructing brick by brick on-site.

Trade union jurisdictions and work rules may also affect construction time. Building construction trade unions may have a vested interest in specific methods and construction processes. Where shop labor is not subject to trade union jurisdiction, it may be possible to bypass certain union rules to shorten construction durations by using prefabricated products and systems.

Erection Time

A project's construction time is affected by, among other things, the extent of prefabrication of its component parts. Erection time may be shortened if a project is composed of mostly discrete building components that have been prefabricated off-site. The various components can be brought on-site, placed, and connected to other elements.

Certain aspects of prefabricated items must be considered, however. Prefabricated elements must, for example, be strong enough to resist lifting and handling. Attachments to other components must be simple, ideally requiring only one construction trade. Adequate clear space must be provided to maneuver prefabricated elements into place. Within these constraints, one may effectively use prefabricated elements to reduce erection time.

The timing of on-site operations must be considered. For example, inclement weather affects the construction time, and may even affect the design process. Winter weather may require that drawings be completed ahead of schedule to allow construction to begin before the onset of cold weather. All of these factors affect the time necessary to erect a building.

Sequencing of Construction Trades

Construction sequence is the order in which the various building trades perform their work, and is within a contractor's control. For example, foundation drains must be placed prior to backfilling. However, the design of a project may contribute to improved sequencing by minimizing the need for "on and off" construction. For example, if a large electrical conduit is placed in the same trench, but above a foundation drain, the construction sequence would be to place the drain, backfill the trench, place the conduit, and complete the backfilling of the trench. Locating the conduit elsewhere allows the contractor to place the drain and conduit independently and do all the backfilling simultaneously, thus eliminating one operation.

The design of a project may limit the ability of various building trades to perform work in

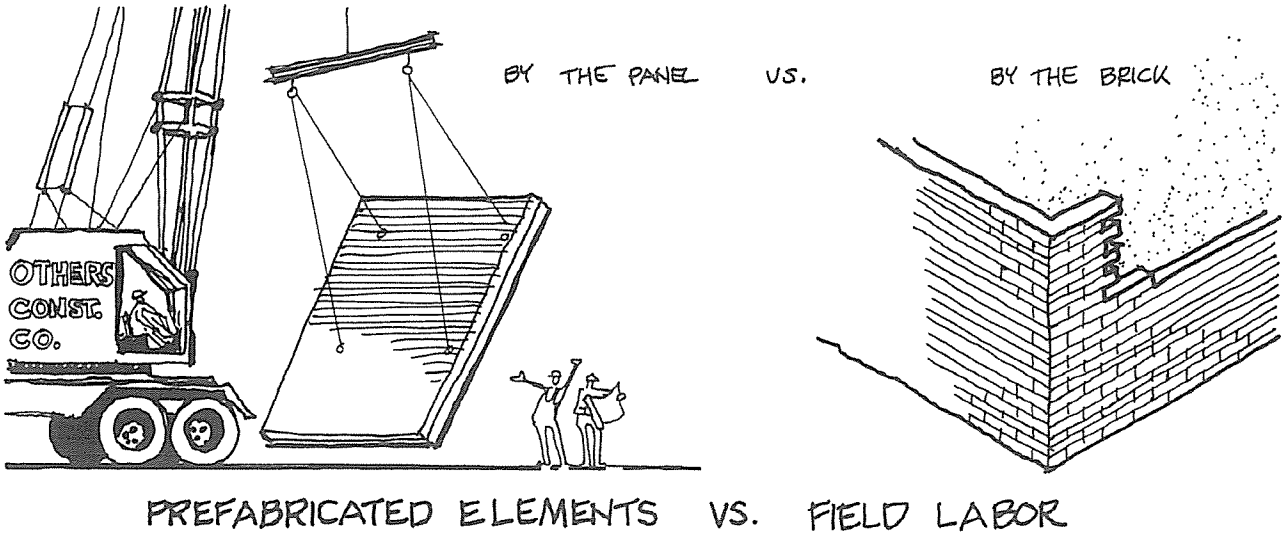


Figure 6.8

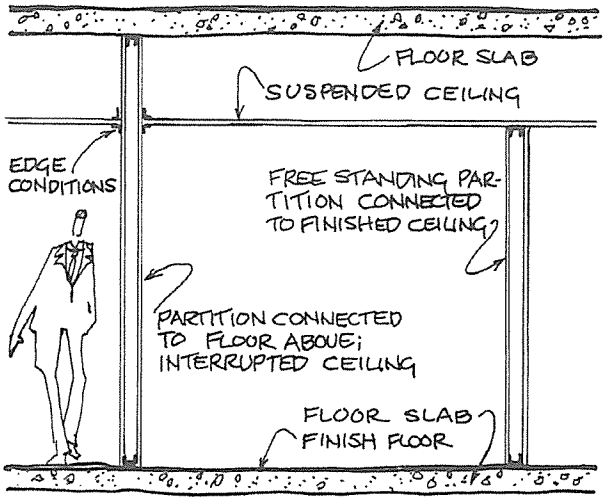


Figure 6.9

a particular sequence. For example, if office partitions are designed to extend to the underside of the floor above, the ceiling installation cannot take place until all partitions are in place. Furthermore, scaffolding required for the ceiling installation must be disassembled and moved from space to space. If the program requirements can be met without the use of full height partitions, or with partitions that extend to the underside of the finished ceiling only, the ceiling contractor can complete larger areas and encounter fewer edge conditions where walls meet ceilings. Furthermore, scaffolds can be moved more efficiently.

Although construction sequencing is the contractor's responsibility, an architect's design can contribute to construction efficiencies by minimizing the need for on-again, off-again labor. Additionally, this will reduce cleanup time, provide for more efficient use of equipment, and avoid potential problems.

Scheduling of Construction Trades

Contractors are responsible for scheduling the various construction trades as well as the sequence of work. Although owners and their architects may establish the total available time for construction as well as interim milestones, they have no responsibility for scheduling construction trades. Architects may, however, establish certain criteria for the contractor's scheduling requirements. Division One, General Requirements, of the specifications may include the following:

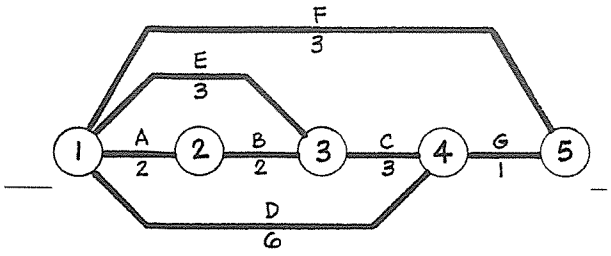
1. That all dates be established for ordering and delivery of materials, for submittals (including time for review, revision, and resubmittal, if necessary), and for testing.
2. That scheduling be done according to the Critical Path Method (CPM). CPM schedules are superior to bar chart schedules because they show interrelationships among activities.
3. That the schedule show the time allotted for each activity, as well as the cost, crew size, and equipment requirements for each activity.
4. That subcontractors provide input related to their scope of work.
5. That the schedule be updated monthly by the contractor to reflect the actual progress and current status. If a project is behind schedule, the contractor may be required to propose a plan for regaining lost time.

Comprehensive scheduling requirements which are fairly administered and enforced will ultimately contribute to a project's timely completion.

SUMMARY

Some architects may find their roles expanded to that of a developer, builder, or manager. Whatever the role, it will be essential for architects to become familiar with new management techniques because they will have an increasing influence over how future construction work is done.

LESSON 6 QUIZ



1. With reference to the CPM network diagram above, select the correct statement.

   A. Activity C cannot begin until both B and E are completed.

   B. Activity G cannot begin until F is completed.

   C. Activity F cannot begin until G is completed.

   D. Activity E cannot begin until A is completed.

2. Referring to the same diagram, what is the critical path?

   A. 1-5 **C.** 1-3-4-5

   B. 1-4-5 **D.** 1-2-3-4-5

3. Referring to the same diagram, what is the critical path time?

   A. 3 days **C.** 8 days

   B. 7 days **D.** 20 days

4. Which of the following would normally influence a contractor's construction schedule?

   I. The quality of construction documents

   II. The reliability of material dealers

   III. The total construction cost

   IV. The size of the project

   V. The anticipated weather conditions

   A. I and IV **C.** I, II, IV, and V

   B. II, III, and V **D.** All of the above

5. A type of project scheduling commonly used in situations where minimum construction time is required is called _____.

6. An architect estimates that design and production for a project will take one year. The client, however, requests that the total time be reduced to nine months. By using the shorter time schedule, what would be the likely outcome?

   A. The general quality of design and production will be unaffected.

   B. The quality of the construction documents will be lower.

   C. The construction budget will be higher.

   D. The construction time will be greater.

7. By shortening an architect's time schedule for design and production of drawings, his or her

   A. labor costs would increase.

   B. overhead would increase.

   C. profit would increase.

   D. documents would be unaffected.

8. Arrange the following tasks for a typical project in ascending order of scheduled time, that is, from the task requiring the least time to the most.

   I. Schematic design phase
   II. Bidding phase
   III. Client approval
   IV. Design development phase
   V. Construction documents phase

   A. II, I, III, V, IV
   B. I, III, II, V, IV
   C. III, I, IV, II, V
   D. III, II, I, IV, V

9. An architect's scheduling and staffing requirements for a specific project are dependent on the project's

   A. size.
   B. cost.
   C. complexity.
   D. quality.

10. Reducing the critical path time will very likely

    A. increase the project cost.
    B. extend the construction time.
    C. have no effect on the float time.
    D. have no effect on project quality.

LESSON SEVEN

BUDGET ANALYSIS AND COST ESTIMATING

THE IMPORTANCE OF BUDGETING

There are many ways to develop a project budget. Private developers, who build for profit, invariably begin with the idea that a certain type of building project in a certain location would be profitable. A more detailed feasibility study is then made that examines the costs of site acquisition, fees, financing, construction, etc. The study also examines the profitability of the project, including its likely income and its costs of operation, such as mortgage payments, taxes, utilities, and insurance.

On the basis of market studies, the developer begins to determine the feasibility of the proposed development. In the case of rental property, the developer studies comparable rental rates; in the case of properties for sale, he analyzes comparable recent sales. The developer then establishes a budget for the proposed building and presents the architect with figures based on the economics of the venture. The architect, utilizing his or her professional skill and knowledge, then advises the developer of the limitations and possibilities of the project budget.

If the project requires a certain number of rentable square feet in order to be economically feasible, the gross size of the building will be determined. However, three basic components then come into play: construction cost, project size, and level of quality. These three components are variable and closely interrelated. For example, if the project size is increased, then the construction cost must also be increased or the level of quality will be reduced. Similarly,

if the construction cost is decreased, then either the project size or quality will decrease as well.

Budgets must also be developed for institutional projects—those built to serve the public—rather than earn a profit. The budget may be based on a planning program prepared by the agency using the facility or by a public building authority acting on the agency's behalf. Such a budget may become the basis for an appropriation by a legislative body, and therefore it must be reliable. Construction funds may have to be apportioned over a period of years and should therefore allow for inflation.

When a project architect is hired, that person must analyze the client's building program in relation to the construction budget. If a conflict between program and budget is found, an adjustment will have to be made in one factor or the other, otherwise the quality of work may suffer. Site conditions are among the most common sources of program or budget adjustment. Adverse geological conditions, for example, can result in added costs for excavation, grading, or utility installation. Unanticipated costs such as these can have a significant effect on the funds available for building construction. For projects with fixed budgets, adjustments in building size or quality may be necessary when high unanticipated costs occur. In such instances, it may be difficult for an architect to design to an acceptable quality level without reducing the size of the project.

These realities of the development process illustrate the importance of employing experienced professionals during the building project development in order to establish a workable balance among the variables of cost, size, and quality.

Inflation is another factor in project development planning because a fixed budget in an inflationary period purchases less each day. An inflation factor should be included in the budget, and delays in project development should be reduced to a minimum. Good project planning will avoid, or at least lessen, the added costs of inflation.

It is important that project budgets be developed concurrently with building programs, that they be well planned, and that they convey a clear understanding of goals and priorities. Among the most critical budgetary decisions are those made during the earliest stages of development. Life-cycle costing, the economics of the full life of a building system, is a budgetary tool that the sustainable design approach encourages. It is a broader evaluation of the cost of architectural elements that consider more than the first cost of a component. Life-cycle costing considers also the maintenance and energy costs (operation) of the architectural system.

PROJECT DEVELOPMENT BUDGET

The total development cost of a project includes far more than the cost to construct the building; site costs, furnishings, professional services, and fees for permits, inspections, and financing must also be considered. In order to avoid unnecessary expense, a project budget should be prepared prior to committing large amounts of time, effort, and money. There are several ways to prepare a budget. Although no two projects are identical, and each situation involves somewhat different factors, certain similarities do exist between projects.

Therefore, it is possible to use standardized budget outline forms that apply to most situations. Some public institutions develop their

own outlines, and it is common practice for an architect to follow such an established format. Since the basic items in a project budget are similar, although they may be expressed differently, it is not difficult to use modified formats. An example of a typical project budget is illustrated in this lesson.

As previously mentioned, development budgets should consider the possible escalation of construction costs. Since these are projected at the time the budget is prepared, reliable historical figures must be applied and assumptions made regarding probable increases. It is normal practice to anticipate construction cost escalation on the basis of an annual increase, projected to the midpoint of construction. Care must be taken to use indexes that are applicable to the type of project, type of construction, and geographic location being considered.

Budget Composition of Example Project

In order to consider the various parts of a project budget, a hypothetical project will be examined, and the applicable categories discussed.

A division of a state university, specifically a research institute, plans to construct a laboratory of desert biology on a site donated by the state. The building program has been developed, and each function and space has been programmed in terms of function, area, and relationships.

The gross area of the building is 10,000 square feet, yielding approximately 6,400 net usable square feet. The site is gently sloping desert land without major improvements. It is bounded on one side by a paved secondary road; however, all utilities (water, gas, sewer, power, and communication) must be brought to the site from a point 3,000 feet to the north within existing easements along a road to be paved by the state. Site development will include parking for 25 cars, drives, curbs, gutters, concrete walks, landscaping, and irrigation.

Approximately 60% of the net usable area will be used for so-called "wet laboratories," which include water, gas, compressed air, distilled water, and sinks with chemical drains. The remaining net usable area will consist of office, library, cold storage and freezer rooms, animal rooms, aquatics rooms, plant rooms, data processing rooms, shop, and stock rooms. There will also be toilets, mechanical rooms, and circulation space, which constitute the remainder of the building's gross area.

The entire building will be air conditioned, and a special exhaust system for the laboratories is required. A uniform lighting system, achieving a minimum intensity of 75 foot-candles at the task level is specified. The building will be equipped with laboratory furniture, including acid resistant tops, sinks, and waste pipes. An internal communication system connected to the public telephone system is to be provided with instruments located in each laboratory and each office.

An architect has been asked to prepare a budget for the development of the entire project, from design through completion, which will be used as a capital outlay estimate to procure private funds for the development of the facility.

It is important to distinguish between the project budget and construction estimates, which will be developed later. The purpose of the project budget is to develop cost parameters within which the owner and architect will work. Construction estimates, on the other hand, generally require adjustments during the course of development. The project budget establishes development cost limits, which reflect all anticipated costs.

To ensure inclusion of all possible expenditures, it is helpful to develop a budget outline form, as shown in Figure 7.1. Applying the budget outline form to our example project, it is now possible to prepare a project development budget, item by item, as follows:

1. Site Acquisition

Since the site has been donated to the institution, no major direct costs are incurred. To transfer title, both parties agreed to a sale price of one dollar. When land acquisition involves a conventional sale and purchase, items such as purchase price, commissions, legal fees, and other transfer costs must be included as part of the total project cost. Since our example site was donated, no amount is entered on this line.

2. Construction

- Off-site work includes all improvements *outside* of the property lines of the project. This work may include basic utilities and all services required to make the development operable. In this project it is necessary to budget for the installation of water service, gas service, sewer line, power lines (underground or overhead), and communication lines from a point 3,000 feet to the north. These services are located in public easements along the road. Paving of the road, as well as installation of curbs, gutters, and storm drains will be paid for by the state. The size of each of these services will have to be determined and the costs estimated by the state or the architect's consulting engineers. Costs are determined on the basis of dollars per lineal foot for trenching, piping, conduit, and cable. These unit costs, multiplied by 3,000, will provide the budget figure for off-site development costs.
- On-site work includes all improvements *within* the property lines but excludes the building itself. This may include roads, walks, parking areas, landscaping, sprinklers, lighting, pools, fountains, walls, fences, etc. In preparing the budget for on-site work, the architect must be aware of any unusual site conditions that may require special work, such as blasting where rock is encountered. Here again, the architect's consulting engineers can furnish unit cost information for various elements of site work.

  Experience may help the architect determine what percentage of the total construction cost is apportioned to site work. It is not unusual to allow between 10 and 20% of the construction cost for this. In the case of our example project, the budget must include installation of all utilities and services from the point of entry at the property line to the building, the installation of a paved parking lot for 25 cars (approximately 10,000 square feet), and all necessary driveways, service roads, curbs, gutters, storm drains, concrete walks, landscaping, and irrigation. Items such as works of art, special lighting, and signage should be included in a separate budget item provided for this purpose.
- Building cost must include all work related to the structure and its systems. To estimate the cost of construction, the architect makes use of various cost data sources which are based on recent and relevant examples. One such data source is the *Dodge Building Cost Calculator and Valuation Guide*, published by McGraw-Hill. This provides unit cost figures for buildings of varying qualities in the following categories: 1) Residential, 2) Commercial/Industrial, 3) Public, 4) Medical, 5) Educational/ Religious, and 6) Miscellaneous. This source also includes cost multipliers, which adjust for varying geographic locations in the United States. Such cost tables provide accurate average unit costs.

BUDGET OUTLINE FORM

Name of Project: _____

Date of Budget: _____

Anticipated Construction Start: _____

Net Area: _____ Square Feet

Gross Area: _____ Square Feet

Efficiency Ratio: _____ Percent

1. Site Acquisition _____
2. Construction _____
   a. Off-site work (roads, utilities, etc.) _____
   b. On-site work (roads, utilities, walks, paving, landscaping, irrigation, site lighting, etc.) _____
   c. Building (structure and all work to 5 feet outside exterior walls) _____
   d. Fixed equipment (built-in counters, cabinets, etc.) _____
   e. Furnishings and equipment (movable equipment) _____
3. Professional Services (surveys, soils analysis, planning, architecture and engineering, plan checking, special consultants, etc.) _____
4. Miscellaneous Costs (advertising, sewer connection fee, water connection fee, building permit fee, legal fees, etc.) _____
5. Inspection and Testing (job inspection, material testing, etc.) _____
6. Contingencies (bidding contingency, cost escalation and contingency, construction contingency, etc.) _____
7. Financing (loan fee, interim financing costs, permanent financing costs, bond legal fees, etc.) _____

Figure 7.1

Another method of calculating the building cost is to determine local unit costs, based on a certain quality of construction, and adjust this to the degree of complexity of the specific project. Our example building will be built of either masonry or concrete, it will contain a large number of spaces equipped with services and utilities, and it will have a number of special requirements, such as cold rooms. It will have above-average quality finishes to minimize maintenance and laboratory fixtures with special tops and storage cabinets. As a result, an above-average structure with a 20 to 50% premium can be assumed. The basic standards of quality should be established at this stage, including illumination, floor, wall and ceiling finishes, hardware, casework, etc. Based on these standards, the architect can establish a unit cost, which is multiplied by the gross area of the building to obtain the total construction cost.

3. Professional Services

This includes the cost of a topographic survey furnished by a licensed land surveyor; the preparation of a preliminary soil analysis and a soil report, including recommendations for bearing values to be used in the design of footings; any work involving site or master planning in excess of normal architectural services; the cost of all architectural and engineering services, from the inception of the project through the administration of the construction contract, which includes all work provided by civil, structural, electrical, and mechanical engineers, landscape architects, and interior designers; the cost of special consultants such as acoustical engineers; and, possibly, the cost of special consultants to check completed drawings for conformance to codes and safety orders.

These costs can be estimated by reviewing records of previous projects and are dependent on the complexity of the project. In general, they amount to about 10 to 15% of the cost of construction.

4. Miscellaneous Costs

Additional costs contained in the project budget include advertising for bids, fees for sewer and water connections to city services, building permits, fees for attorneys, etc. These costs vary according to the size of the project, and it is best to consult local authorities and the owner to establish an amount for these items.

5. Inspection and Testing

This category includes the salary of a full-time, on-site inspector engaged by the owner (if the project requires such services), as well as costs for testing soil compaction and strength of concrete, welding inspections, etc. The on-site inspector's monthly salary may be multiplied by the duration of construction.

6. Contingencies

Unforeseen developments prior to and during construction must be considered in the project budget. It is normal practice to allow a bidding contingency of between 5 and 10%. Inflation can be projected in several ways, for example, by projecting cost indexes as a straight line, based on cost escalations of the past year or two. Escalation of cost should be calculated to the midpoint of construction in order to arrive at an average.

A construction contingency of between 5 and 10% may be included to cover unavoidable change orders. These may occur as a result of the owner's need to include additional items, as well as costs resulting from unforeseen site conditions.

DESERT BIOLOGY LABORATORY BUDGET

Date of Budget:	December, 1998		
Anticipated Construction Start:	July, 1999		
Net Area:	6,400 square feet		
Gross Area:	10,000 square feet		
Efficiency Ratio:	64%		
1. Site Acquisition		$ -0-	
2. Construction			
a. Off-site work		297,000	
b. On-site work		330,000	
c. Building		825,000	
Sub-Total:			$ 1,452,000
3. Professional Services			
a. Surveys		4,950	
b. Soils Analysis		1,650	
c. Architecture/Engineering		115,500	
Sub-Total:			122,100
4. Miscellaneous			
a. Advertising		450	
b. Sewer Connection		3,300	
c. Water Connection		1,500	
d. Building Permit		1,800	
Sub-Total:			7,050
5. Inspection and Testing			
a. Inspector (12 months)		24,750	
b. Testing		4,950	
Sub-Total:			29,700
6. Contingencies			
a. Bidding Contingency		72,600	
b. Cost Escalation Contingency		145,200	
c. Construction Contingency		72,600	
Sub-Total:			290,400
7. Financing		-0-	
Total:			$ 1,901,250

Figure 7.2

7. Financing

These costs include loan origination fees, interim financing costs during construction, and permanent financing costs for "take-out" or permanent mortgages. If a public institution requires the sale of revenue bonds, the necessary legal fees must be included in the project budget.

The sum of all these items provides the total cost to develop the project. Interior furnishings, sometimes referred to as "fitting out," are usually treated separately. The project's design should not proceed until both owner and architect are satisfied that the project is feasible within the constraints of the budget.

Using this format, a budget for the aforementioned laboratory of desert biology is presented. It is interesting to note that nearly one quarter of the total project development costs may be budgeted for items other than construction.

COST ESTIMATING

Cost estimating is a highly developed technique with which architects should be fully familiar. Some architects are highly skilled estimators, while others employ expert cost estimators on their staffs. There are also independent cost consultants available to architects, owners, and contractors. When a professional estimator is consulted, an architect should become familiar with the methodology to be employed, the information needed by the estimator, and the critical periods during the development stages when estimates are appropriate. The reliability of cost estimates invariably depends on the accuracy of the base information and the conscientiousness with which the work is performed.

In order to avoid misusing design time and wasting energy, an architect should have an accurate idea of likely costs at each stage of the project development. The methods of preparing budget estimates at the pre-planning and proposal phase have already been discussed. These are often single unit costs based on such parameters as cost per student, cost per hospital bed, cost per square foot of floor area, or cost per cubic foot of building volume. The cost analysis methods commonly used at various stages of project development are as follows:

- At the *programming phase*, the unit cost system, that is, cost per square foot, is quite appropriate. This is usually based on recent experience with similar types of buildings, adjusted by size, location, quality, etc. Costs may be related to the functional activities of each space, for example, square foot cost of wet laboratories versus square foot cost for offices and secretarial spaces. Distinguishable spaces that are calculated separately increase the accuracy of the estimate.
- In the *schematic design phase*, it is helpful to employ cost information on the major elements of each building subsystem. This enables cost comparisons between different conceptual solutions and allows, for example, a comparison between steel and concrete structural framing systems. This holds true for all of the major subsystems: air conditioning, electrical distribution, lighting, plumbing, etc.
- During the *design development phase*, detailed component costs are required, which permit a more precise selection of components and systems. With more accurate knowledge of probable costs, the architect may suggest changes if estimates indicate that costs will exceed the project budget.

- In the *construction contract documents phase*, when working drawings and specifications are prepared for bidding, it is necessary to use composite unit rates for construction components, assemblies, and systems. These unit rates are required for pre-bid estimates, final cost checks, and the contractor's cost breakdown. This information is also used during construction as a basis for verifying the contractor's payment requests.

General construction cost data is readily available and published in a wide variety of forms. Commercial publications or trade journals regularly furnish information on detailed unit prices, as well as the costs of common building types. Major construction companies also have current price information and will advise owners and architects on a professional basis.

Cost data furnished by contractors is usually categorized by building trades, similar to the way construction work is administered. However, these divisions, which parallel the format of specifications, may not provide a convenient framework for cost estimating during the programming or design phases. Effective cost control requires a framework based not on building trades but on the component parts of a building, often referred to as subsystems, functional components, elements, or assemblies. Institutions or companies that do a great amount of building, such as government agencies, universities, large corporations, chain stores, etc., regularly use component cost estimating formats. Two examples are illustrated here.

Sample Cost Format A

The format is for construction cost only, without fees.

1. Structural
   A. Foundations
   B. Floors on grade (including columns)
   C. Floors above grade (including columns)
   D. Roof deck
2. Exterior walls
3. Interior walls and partitions
4. Finishes
5. Vertical circulation
   A. Stairs
   B. Elevators
6. Specialties
7. Equipment
8. Plumbing
9. HVAC (Heating, ventilating, and air conditioning)
10. Electrical
11. Site work

Sample Cost Format B

This format is considerably more detailed than Format A. It reflects total project costs, including fees. Total costs are therefore greater than construction costs alone.

1. General conditions, fees, and permits
   A. Temporary services and roads
   B. Field office, temporary power, field toilets, etc.
   C. Head office overhead and profit
   D. Professional fees
   E. Permits
2. Substructure
   A. Normal foundations
   B. Basement excavations
   C. Roof construction
   D. Roof finish and insulation

3. Horizontal structural elements
   A. Slabs on grade
   B. Suspended floor slabs
   C. Roof construction
   D. Roof finish and insulation
4. Exterior cladding
   A. Walls below grade
   B. Walls above grade
   C. Windows
   D. Exterior doors, entrances, and screens
   E. Projections, balconies, etc.
5. Interior vertical elements
   A. Permanent partitions and doors
   B. Demountable partitions and doors
   C. Glazed partitions and doors
   D. Folding or sliding partitions
6. Multi-story elements
   A. Stairs, steps, ladders
   B. Chutes
   C. Catwalks, gratings
   D. Elevators, escalators, hoists
7. Interior finishes
   A. Floors and base
   B. Ceilings
   C. Walls
   D. Special finishes
8. Fittings, furnishings, and building equipment
   A. Building equipment
   B. Special equipment
   C. Built-in furniture and fixtures
9. Cash allowances
   A. Hardware
   B. Graphics (signage)
   C. Miscellaneous
10. Alterations and renovations to existing structures
11. Site preparation and development
   A. Demolition, site preparation, drainage
   B. Utilities (including mechanical and electrical site work)
   C. Utility tunnels
   D. Roads and parking areas
   E. Pedestrian walks and steps
   F. Exterior illumination
   G. Site furniture
   H. Ancillary structures, fences, etc.
   I. Landscaping, planting
12. Plumbing and drains
   A. Plumbing and drains, roughing-in
   B. Plumbing fixtures and hardware
   C. Fire protection
   D. Special services systems
13. Heating, ventilating, air conditioning
   A. Mechanical equipment
   B. Heating system
   C. Air conditioning
   D. Ventilation system
   E. Controls
   F. Plant
   G. Special systems
   H. Testing and adjustment
14. Electrical
   A. Equipment
   B. Transformers and main distribution
   C. Power and lighting distribution
   D. Lighting fixtures
   E. Underfloor duct systems
   F. Communication systems
   G. Special services
   H. Safety and security systems

A useful listing of elemental categories for building cost analysis was prepared for the *P/A Building Cost File*. In addition to the elemental categories, this includes:

- a description of elemental categories and units of measurement;
- rules of measurement for areas and volumes of buildings; and
- a building classification code.

Construction trade costs are far more useful when converted into working indexes, such as described above. Once costs are redefined in this manner, the working relationship to programming and design is established. Each building cost analysis should be accompanied by information regarding the estimating basis or technique, so that it can be checked, modified, or corrected.

For comparative purposes, it is convenient to use a simple measure of cost that can be applied to a wide range of building types and building systems. The unit cost system best fits this need. Unit costs describe a specific element as a quantity, for example, curtain wall costs are expressed as "square feet of curtain wall area." This system enables estimators to apply cost data accumulated from one building to a different building type, provided the design and performance criteria are similar. Thus, a structural system for given spans, loads, and height may be transposed from an office building to a university classroom building.

Building cost analysis is useful to the extent that it considers the desirable performance criteria. For example, the cost analysis for partition systems should take into account height, frequency of doors and other openings, fire resistance, and sound transmission requirements.

An office file that documents building cost information on this basis is an excellent and reliable system; however, to be useful, it must be broadly based and reflect a wide range of recent experience. For that reason, it is difficult for small architectural offices to establish extensive data systems and keep them current. Large architectural, contracting, and cost estimating firms often use computer-based data, but smaller offices more often rely on outside reference sources. Whatever the source, the most useful and reliable method invariably involves an expert estimator, a responsible contractor, and dependable information.

Collecting data for a building cost file requires the organization of information in *elemental categories and units of measurement*. Elemental categories and units of measurement comprise all the elements of a building, arranged in the usual sequential order of construction. Each element is described and related to its appropriate unit of measurement, such as square feet, linear feet, or cubic feet.

There are seven major cost areas:

100 *Foundations* include all those elements which support the structure.

200 *Building shell* includes the basic superstructure of the building, the exterior envelope, and the roofing.

300 *Interiors* include all architectural interior finishes, partitions, built-ins, specialties, and equipment. These costs are largely influenced by the functional requirements of the spaces.

400 *Conveying systems* include escalators, elevators, etc. Costs are closely related to building height.

500 *Mechanical and electrical* include all elements of the mechanical and electrical systems except exterior services (900).

600 *General conditions and profit* include the contractor's provisions for general conditions, site overhead, and profit.

900 *Site development* includes excavation, grading, utilities, roadways, landscaping, etc.

Each of the main categories is further divided into more detailed classifications. Items which are included and excluded in each category and the appropriate units of measurement are noted. This detailed listing relates trade costs to building component costs, which allows a practical comparison of values. Note that categories 700 and 800 are not assigned; they are reserved for special items.

Floor areas and volumes are calculated according to standard rules of measurement, which ensures that unit rates are consistent from one project to another. There are several rules of measurement, some of which apply to commercial buildings while others apply to institutional buildings. Large corporations that do a considerable amount of building may use their own particular rules.

Calculations should be made for both gross and net floor area. This allows one to compare the space efficiency of different designs and to relate costs to a unit of net usable building area.

The building volume measurement permits one to translate costs into dollars per cubic foot. The ratio of gross floor area to building volume is also a useful measurement because it takes into consideration the floor-to-floor height.

A *building classification code* establishes a convenient system to identify, classify, and store information on various projects.

The ultimate purpose of establishing a cost file is to enable one to analyze the costs of a proposed project.

Cost figures are based on bid prices, with no adjustments made for construction changes or geographic variations. This form of cost analysis saves time and effort, and it provides an efficient pricing system during the early programming and planning phases.

Parameter Costs

A second system of estimating costs, checking bids, and controlling costs was originally developed by *Engineering News-Record* (ENR) and is called *parameter costs of buildings.* The data derives from contractor-reported actual costs, which are published in detail for each project.

The parameter method bases the unit cost of each trade on the physical parameter (measure) of the building that is the main determining cost factor, among the 15 parameters used. For example, the "gross area supported" is used to calculate the unit cost of structural steel or whatever structural system is used. Items such as acoustical ceilings, resilient flooring, carpeting, sprinklers, plumbing, electrical fixtures, etc., are based on the "net finished area" parameter.

Using parameter costs is more accurate than basing the unit cost of each trade on total area or volume. ENR's parameter cost files are stated as unit cost ranges for each major trade. The range is based on 50% of projects centered about the median, using contract prices updated from construction start date to present, using the ENR Building Cost Index.

Parameter costs of buildings are useful in developing feasibility studies, determining preliminary budgets, aiding design decisions and cost-cutting procedures, determining and checking bids, and simplifying cost control. Given a building concept, architects can use building parameters to calculate preliminary costs quickly. Moreover, appropriate values of cost-saving alternatives may also be obtained.

A parameter estimate can be adapted for use in another location by applying ENR's 20 Cities Building Cost Index. It can also be updated by multiplying by an inflation factor. However, more reliable results are obtained when indexes in the same region are updated.

Table 7.1 illustrates a construction cost budgeting system that uses the ENR cost parameters. If a new hotel with a similar budget were being planned, an estimator could generate valid parameters and probable unit costs for the proposed hotel by expanding the given trades classifications and unit costs shown. The new tabulation would have the same form; however, the parameter unit costs would differ based on the judgment of the estimator and geographical factors.

During all phases of design, the budget of each component must be controlled to ensure that cost targets are not exceeded. In the early stages of development, detailed estimates are impractical; however, general comparative costs can be projected.

Referring to the cost breakdown of a project in Table 7.2, let us examine an example of value engineering analysis. Note that the cost of structural steel is estimated at $270,000. Four structural alternatives were selected for comparative cost study:

1. Prefabricated reinforced concrete
2. Prefabricated prestressed concrete
3. Prefabricated steel with solid web beams
4. Timber

Studies of these four alternatives yielded the following costs:

1. Prefabricated reinforced concrete: $282,000
2. Prefabricated prestressed concrete: $288,000
3. Prefabricated steel: $270,000
4. Timber: $290,000

From this analysis it is clear that a prefabricated steel structure is the most economical. This type of analysis can be made for each of the major building components. Those items that exceed the parameter costs may have to be balanced by compensating reductions in other components, or the project budget may have to be adjusted.

Upon completion of preliminary design, the construction cost estimate should be reviewed with the owner for approval. The cost objectives established in preliminary design will determine the cost of the final design.

To examine another component, the budget for toilet partitions has been set at $3,080. According to the preliminary design, the project has a total of 17 toilet partitions. Shown below are the five partition types considered, with their unit costs and total costs:

Marble	$500 × 17 = $8,500
Metal	$200 × 17 = $3,400
Porcelain enamel	$300 × 17 = $5,100
Stainless steel	$430 × 17 = $7,310
Pressed wood	$140 × 17 = $2,380

The pressed wood partition would have the lowest cost and would realize an initial saving of $700, based on the original budget of $3,080. Since durability is essential, however, this partition material is unacceptable. Therefore, the next lowest cost partition, metal, is recommended. The anticipated partition cost overrun is $320, and this overrun must be absorbed in one of the other components.

This analysis illustrates the technique of value engineering; it also indicates that the parameter system is not entirely flawless. A budget must

			Parameter Cost:			Total Cost:
		TRADE:	CODE	Unit	Cost	Amount
Type of building	Hotel	Gen'l cond. & fees	5	sf	$4.60	$296,000
Location	Anytown, U.S.A.	Site work	—	—	—	30,000
Construction start/comp	January 1985/March 1986	Utilities	—	—	—	30,000
Spec. site cond	Rock in basement	Roads, walks	—	—	—	4,000
Type of owner	Private	Landscaping	—	—	—	—
Frame	Structural steel	Excavation	3	sf	11.24	70,000
Exterior walls	Masonry	Foundation	3	sf	9.64	60,000
Fire rating	2-hr.					
	–	Precast concrete	—	—	—	—
PARAMETER MEASURES:		Calssons, pilings	—	—	—	—
1 No. of floors, excluding basement	7	Con. arch	5	sf	4.98	320,000
2 No. of Floors, including basement	8	Ext. masonry	10	sf	300	300,000
3 Basement plan area	6,225 sf	Int. masonry	7	lf	8.00	80,000
4 Basement area, total	6,225 sf	Stone, granite, marble	—	—	—	—
No. of basement floors	1	Structural steel	5	sf	7.76	500,000
5 Gross area supported (excl. slab on grade)	64,374 sf	Misc. metal	2	flr	7,500	30,000
		Ornamental metal	—	—	—	4,000
6 Face brick area	31,300 sf					
7 Interior partitions	10,000 lf; masonry, drywall	Carpentry	7	lf	5.60	56,000
8 Curtain wall, incl. glass	840 sf	Curtain wall	8	sf	78.58	66,000
9 Net finished area	93,963 sf	Waterproofing and dampproofing	8	sf	4.76	4,000
10 Other exterior masonry wall	1,000 sf	Roofing and flashing	15	sf	1.58	40,000
11 Number of elevators	2	Metal doors and frames	—	—	—	—
12 Store front perimeter	80 lf	Wood doors, windows	7	lf	0.36	3,600
13 No. fixtures (pl.) sinks, toilets	500	Hardware	2	flr	5.000	20,000
14 Parking area	250 cars					
15 Roof area	25,458					

Table 7.1

		Glass & glazing	8	sf	28.10	23,600
		Store front & lobby	—	—	—	23,600
OTHER MEASURES:		Metal windows	—	—	—	—
Area, typ. flr	10,729	Lath and plaster	—	—	—	—
Lobby area	2,640 sf	Drywall	9	sf	3.40	320,000
Air cond	Gas window	Tile	13	fixt.	73.60	36,800
No. of rooms	152	Terrazzo	—	—	—	—
No. of laboratories	—	Acoustical ceiling	9	sf	1.28	120,000
Story height	10 ft.	Resilient flooring	—	—	—	—
Swimming pools	—					
No. of apartments	—	Carpet	9	sf	1.86	120,000
		Painting	9	sf	2.02	130,000
		Toilet partitions	13	fixt	8.00	4,000
		Special equipment	—	—	—	270,000
		Elevators	11	ea	80,000	160,000
		Plumbing	9	sf	4.90	460,000
		Sprinklers	9	sf	0.10	10,000
		HVAC	9	sf	4.08	384,000
		Electrical: Contracts	9	sf	4.26	400,000
		Fixtures	9	sf	0.42	40,000
		Miscellaneous trades	—	—	—	120,000
		Parking	—	—	—	28,000
		TOTAL				4,620,000

Table 7.1 (continued)

be based on reality. The real conclusion of this analysis is that the original budget may have been flawed, and that an estimator's professional judgment is more reliable than any mechanical system.

Other Cost Variables

Project location is a major factor in influencing construction costs. This is particularly important when published cost indexes are used to convert cost data from one locality to another. Subdivided geographical areas of the country must consider labor rates, material prices, construction activity, and the availability of labor. Variations within geographical regions, particularly between urban and rural areas, must also be considered, as well as the possibility that certain regions may experience a change in cost patterns. Additional factors influencing costs include population densities, construction volume, wage levels, number of construction firms, etc.

From all of this the following conclusions can be drawn:

- There is a direct correlation between labor rates, material prices, and construction costs.
- Construction costs decrease as one moves away from heavily populated urban areas, until construction locations become remote and inaccessible, at which point costs rise rapidly.
- Costs in rural or remote areas tend to be less predictable than in urban areas due to fluctuations in the construction market, lack of stable labor, and material delivery problems.

Trade	Budget Amount
Civil	
Site work (clearing, drainage)	$ 110,000
Roads, walks	59,400
Civil Budget	169,400
Architectural	
Landscaping	24,700
Exterior masonry	92,500
Miscellaneous metal	9,725
Carpentry	94,185
A/C enclosures	21,490
Waterproofing & dampproofing ..	67,600
Roofing and flashing	8,230
Metal doors and frames	114,000
Hardware	22,440
Glass and glazing	20,000
Drywall	25,800
Tile work	10,250
Acoustic ceiling	7,350
Resilient flooring	5,700
Carpet	46,000
Painting	47,600
Toilet partitions	3,080
Special equipment	60,430
Architectural Budget	681,080
Structural	
Excavation	15,900
Conc. arch or formed concrete ...	112,060
Structural steel	270,000
Structural Budget	397,960
Mechanical	
Plumbing	99,000
HVAC	240,500
Mechanical Budget	339,500
Electrical	
Contracts	260,000
Fixtures	2,420
Electrical Budget	262,420
General Conditions Budget ..	205,540
TOTAL	$2,055,900

Table 7.2

- Rural and semi-urban areas are dependent on neighboring metropolitan areas, and they are influenced by distance and transportation access. The construction industry of a metropolitan area generally services the outlying areas.

The factors that contribute to construction cost differences, therefore, are: the availability of labor and materials, the resources to produce or fabricate materials, and the convenience of available transportation systems.

Construction costs are affected by a variety of influences; for example, when oil becomes scarce, fuel costs rise and construction costs increase. When construction activity exceeds what the local labor market can provide, labor costs rise. When industrial wages are increased, the price of fabricated building components must rise as well.

Interest rates charged to developers have a substantial influence on construction volume, with resultant effects on labor and materials costs. High interest rates invariably cause a significant reduction in housing starts, which is normally followed by a decline in softwood lumber prices. This is illustrated by Figure 7.3, which shows that in the severe slump of 1973–74, lumber prices plunged some 20%.

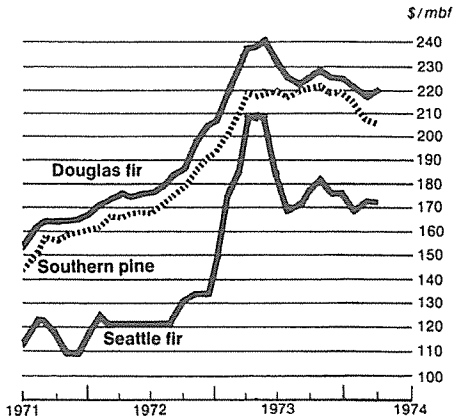


Figure 7.3

The demand for wage increases and fringe benefits by building trade unions is the largest single influence on labor costs. These increases are more often based on cost-of-living increases than on an increase in productivity. Labor union pressures normally decrease as construction activity is reduced, when emphasis is placed on minimizing the loss of jobs.

It is clear that any single influence, whether it is price control, credit control, shortage, demand, or supply can have a considerable effect on the overall cost of construction.

CONSTRUCTION OVERHEAD AND PROFIT

Overhead costs usually include all the general costs of operating and maintaining a contracting business plus all project expenses that are not included in material, labor, or equipment costs. Overhead costs can be assigned to either of two categories: general overhead costs or project overhead costs.

General Overhead Costs

Included in this category are all costs that cannot be charged to a specific project. Costs such as rent, for example, are continuous, although they may vary with the volume of construction and the number and size of projects being handled by the firm.

General overhead costs may range as high as 8 to 15% of the total value of business for a large firm. The following list illustrates the various items constituting general overhead costs. All projects will include some of these items, and a few projects will include them all.

General Overhead Costs:

Advertising
Automobile
Consulting fees
Entertainment
Furniture
Heat
Insurance
Interest
Legal expenses
Rent
Salaries
Stationery
Supplies
Taxes
Telephone
Travel
Utilities
Wages (staff)

Project Overhead Costs

These include all costs that can be charged to a specific project but cannot be attributed to labor, materials, or equipment.

Project overhead costs depend on the type of project and the difficulties encountered during the work. These costs vary from 4 to 10% or more of the cost of construction, or from 10 to 20% of labor costs alone. The following list illustrates the various items that constitute project overhead costs. Each project normally includes several of these. (Note that payroll taxes are usually a part of labor costs, not project overhead.)

Project Overhead Costs:

Bonds
Equipment storage
Heat/air conditioning
Insurance
Interest
Light, power, water
Office maintenance
Permits
Project office
Project telephone
Sanitary facilities
Security
Stationery and supplies
Taxes
Temporary enclosures
Temporary walks and stairs
Transportation
Trash removal

Total overhead costs may vary from 5 to 20% of the total construction cost, or from 10 to 40% of the labor costs alone. The actual amount depends on the locality and type of project.

Other than the general building permit, contractors must often secure permits to cross a sidewalk, erect shelters over a sidewalk, store gasoline or other hazardous materials, construct temporary buildings, maintain sanitary facilities, obtain water or power, open streets for utilities, repair pavements, use dumps, and transport heavy or wide loads over city streets.

A contractor may also be required to secure surety or guarantee bonds, proposal or bid bonds, performance bonds, and labor and material payment bonds. Certain types of insurance may also be required by law or by the owner, as shown on the following lists.

General Insurance:
Fire
Owner's contingencies
Property damage
Public liability
Windstorm
Workers' compensation

Miscellaneous Insurance:
Automobile
Boiler
Earthquake
Flood
Forgery
Payroll
Plate glass
Rain
Theft
Vehicle
Wind

On most construction projects the contractor must make interest payments to finance the costs of labor and materials until progress payments are received. These interest payments are included in the project overhead. If the contractor, rather than the owner, is required to pay property taxes on a structure during construction, these taxes are also included as overhead.

There are several methods of apportioning overhead costs. The optimal way is to charge actual costs to each project, which requires, of course, that such costs can be determined accurately. The more common method is to apportion general overhead costs among all projects. In some instances, general overhead costs are divided equally among each of the projects; in others, according to the length of time required to complete each job.

The federal government and some states levy payroll taxes, which are normally a part of the contractor's labor costs. Included are Social Security Tax, Federal and State Unemployment Insurance Tax, and Disability Insurance Tax.

Profit

The amount of a contractor's profit is usually expressed as a percentage of the total estimated costs of materials, labor, equipment, and overhead. This percentage varies according to the type of project, size and amount of the contract, and the time required for completion. Smaller or more risky projects, for example, usually command a larger profit percentage. The profit percentage also depends on how anxious a contractor is to build a particular project and the bidding climate created by the competition of other contractors interested in the same project.

The percentage allowed for profit varies from 5 to 25%. For smaller projects with many unknowns, the highest percentages are charged. Fifteen to twenty percent is typical for medium-size projects, 10 to 15% for larger projects when unknowns are limited, and from 5 to 10% for very large projects. Unknowns include such risk factors as local labor conditions, weather, and the owner's financial solvency.

CONSTRUCTION COST ESCALATION

The cost of construction is based on the cost of raw materials, manufactured materials, and labor, and therefore, it is directly affected by the vicissitudes of inflation. Thus, it is necessary to determine how construction costs relate to inflation, how they vary as a result of external influences, and how to use available information to predict future trends. This is vital for estimating costs of projects in the programming

stage, often one or two years in advance of bidding.

One method is to chart historical curves, based on indexes of construction costs, and project these on a straight line basis. Thus, if a hypothetical index of 100 is set for a base year, such as 1986, and the index indicates 150 for 1991, the cost of construction for 1991 is one and a half times that of 1986. On the basis of this index, the cost of construction shows an increase of 10% per year. In actual experience, however, inflationary cost increases are not uniformly linear, but rather they fluctuate. For very large projects, even a minor fluctuation can involve a large amount of money.

COST INDEXES

There are numerous construction costs indexes published nationally, with price adjustment factors related to region. One group of such indexes is the ENR Construction Cost Index, which appears in *Engineering News-Record*, published by McGraw-Hill. Additional indexes for construction costs, common labor costs, skilled labor costs, and materials costs also appear in the same publication. All of these indexes are calculated by averaging costs in a number of major U.S. cities.

The ENR Construction Cost Index was created in 1921 to diagnose price changes that occurred during and immediately following World War I and to evaluate their effect on construction costs. The index was intended as a general purpose construction cost indicator. It is a weighted aggregate index of constant quantities of structural steel, portland cement, lumber, labor, etc., comprising a hypothetical block of construction, and for years it has indicated the basic underlying trends of construction costs throughout the country.

There are a number of other cost indexes published, based on varying criteria.

Major considerations in choosing an index for cost measuring purposes are:

- desired accuracy;
- material and wage components and respective weightings that make up the index; and
- geographical area covered by the index.

For approximate estimates in the early stages of development, a general purpose cost index is easiest and most economical to use. However, a check should be made to ensure that various components in the index reasonably match those in the structures being estimated. Choosing a specialized index requires careful study of the components and their relative statistical weight, as well as the geographical area to which the index applies.

Calculations for forecasting cost escalation trends must be tempered by such factors as shortages, increased demand, credit availability, and government intervention, including economic incentives or restraints. Nevertheless, cost indexes must be considered an aid, not the final answer to the complex task of estimating project construction costs.

THE FINANCING OF BUILDING PROJECTS

Building projects, whether public or private, can be financed in a number of different ways, which we will examine.

Private Buildings

A private project may have an owner who develops it for the owner's own use, whether it

WAGE RATES, 20-City Average

		% Change From	
	Jan. 1991	Dec. 1990	Jan. 1990
Common	18.58	0	+2.8
Skilled (average three trades)	24.35	0	+3.5
Bricklayers	23.97	0	+3.4
Carpenters	23.29	0	+3.4
Structural ironworkers	25.78	0	+3.6

MATERIALS PRICES, 20-City Average

Asphalt paving, AC-20**	128.88	+5.0	+23.7
Cement, bulk, per ton, TL*	62.10	0	–0.7
Concrete blocks, sand/gravel, 8" × 8" × 16" per hundred*	84.08	–0.5	–6.7
Ready-mix concrete, 3,000 psi, per cu yd*	49.98	+0.7	+5.0
Ready-mix concrete, 5,000 psi, per cu yd*	56.97	+0.6	+6.0
Sand, per ton, CL**	6.92	+0.8	–1.5
	Dec. 1990	**Nov. 1990**	**Dec. 1989**
Conc sewer pipe, 24", prem joint, per ft, CL*†	17.50	–1.6	–2.2
Ductile iron pipe, push-on joint, 6", per ft, CL*	6.44	+2.5	+3.0
Lumber, 2" × 4" fir, per Mbf, CL*	325.99	+0.8	–3.2
Lumber, 2" × 4" pine, per Mbf, CL*	315.31	0	–2.9
Plyform, wood, 3/4", per Msf, CL*	592.22	–0.6	–3.2
Plywood, 5/8", per Msf, CL*	353.10	–2.4	–15.2
Reinforced bars, grade 60, per cwt	17.85	–2.1	–2.7
Structural steel, base, per cwt††	24.97	–0.7	–4.2

* Delivered; **f.o.b. city; CL = carlots; TL = trucklots; † = revised; †† = average of fabricated channel beams, I-beams and wide-flange; na = not applicable because of revisions in quoting method.

Table 7.3

be a private residence or a corporate headquarters building. Most private building projects, however, are conceived by real estate developers, or entrepreneurs, as investments.

A developer may work at a very small scale, building houses or other small income producing projects, or at a very large scale, building skyscrapers, shopping centers, or whole

ENR COST INDEXES IN 22 CITIES

Based on 1913 U.S. average = 100

	CONSTRUCTION COST			BUILDING COST		
	Jan. '91	Percent Change From Last		Jan. '91	Percent Change From Last	
City	Index	Month	Year	Index	Month	Year
Atlanta	3171.55	0	+1.0	2222.40	0	+0.9
Baltimore	3884.43	0	+4.8	2579.90	0	+6.1
Birmingham	3437.29	+0.3	+4.1	2160.84	+0.5	+1.3
Boston	5614.79	0	+4.5	3110.03	0	+0.6
Chicago	4993.36	–0.1	+1.3	2888.16	–0.2	+2.1
Cincinnati	4933.91	0	+1.2	2638.73	0	+1.9
Cleveland	5368.82	0	+4.0	2886.93	0	+4.6
Dallas	3190.69	–0.1	–0.9	2061.61	–0.2	–3.1
Denver	3541.20	0	+3.4	2321.28	0	+2.6
Detroit	5155.54	0	–0.3	2974.47	+0.1	+2.2
Kansas City	4763.94	0	+0.9	2645.28	0	+1.6
Los Angeles	5994.55	0	+3.5	3020.51	0	+5.6
Minneapolis	4798.61	0	+0.1	2648.43	0	+2.8
New Orleans	3602.41	0	+0.3	2220.20	0	+0.6
New York	6847.58	0	+6.1	3848.30	0	+3.7
Philadelphia	5433.52	0	+2.5	3043.10	+0.1	+2.5
Pittsburgh	4580.29	0	+3.3	2711.11	0	+0.8
St. Louis	5099.10	+0.2	–0.6	2610.32	+0.3	–0.4
San Francisco	6055.61	0	+2.1	3245.04	0	+4.0
Seattle	4933.39	0	+0.7	2552.58	0	–0.6
U.S. 20-city avg	**4770.03**	**0**	**+2.2**	**2719.46**	**0**	**+2.1**
Montreal	4977.06	0	+4.9	2803.10	0	+5.9
Toronto	6401.54	0	+6.3	3204.51	0	+3.1

Table 7.4

communities. Because of the complexity of building, developers tend to specialize.

As previously discussed, the developer determines the feasibility of a certain kind of building in a certain place and at a certain scale.

The developer may also determine that a large project might be built in phases. With this vision of a project, the developer has to determine the likely acceptance for the project in a particular location. Is the zoning appropriate? Does the town plan, if it is specific, support the

ENR WAGE, MATERIALS AND COST INDEXES 20 CITIES

Based on each city's 1967 average = 100

	COMMON LABOR		SKILLED LABOR		MATLS. PRICES		Const.	Bldg.
	Jan. '91	% Chg. fr.	Jan. '91	% Chg. fr.	Jan. '91	% Chg. fr.	Cost	Cost
City	Index	Jan. '90	Index	Jan. '90	Index	Jan. '90	Index	Index
Atlanta	397.42	+1.4	366.32	+1.7	375.37	0	389.83	370.34
Baltimore	505.02	+5.5	432.29	+8.5	368.44	+2.8	440.36	403.53
Birmingham	448.16	+6.2	374.98	+3.0	345.59	–0.7	411.98	359.94
Boston	580.36	+7.1	528.45	+3.9	353.83	–5.2	517.68	452.21
Chicago	450.57	+2.0	446.05	+4.1	320.28	–1.2	414.07	389.28
Cincinnati	489.49	+1.9	425.00	+4.4	380.86	–1.2	464.33	412.48
Cleveland	452.23	+2.9	435.57	+2.3	366.98	+8.5	428.46	406.12
Dallas	444.22	+2.3	347.73	+1.1	314.66	–7.5	403.77	341.28
Denver	381.52	+5.0	369.33	+5.2	345.08	–0.2	362.38	354.91
Detroit	441.18	0	462.28	+4.2	323.41	–1.2	411.58	402.38
Kansas City	501.11	+0.7	448.40	+1.5	365.95	+1.6	460.60	408.48
Los Angeles	550.00	1.6	482.96	+1.9	367.74	+13.4	508.42	438.76
Minneapolis	461.11	0	451.79	+4.4	341.06	–0.6	418.48	384.40
New Orleans	469.09	0	371.90	0	359.57	+1.2	430.73	366.10
New York	505.54	+7.5	516.45	+5.4	421.30	0	492.40	483.87
Philadelphia	582.00	+4.2	497.87	+6.1	386.98	–3.7	530.38	452.51
Pittsburgh	447.94	+4.7	401.87	+2.0	335.52	–1.0	411.54	368.11
St. Louis	452.16	+1.0	424.46	+3.6	324.61	–7.1	422.13	382.40
San Francisco	509.47	+0.4	478.85	+1.0	372.10	+10.5	478.42	436.14
Seattle	461.61	+2.6	438.78	+3.2	354.36	–6.6	437.01	403.81

Table 7.5

concept in mind? Is there likely to be community support, or opposition, to the envisioned development?

Some of these questions may not have simple answers, and further investigation may be required. When a developer feels that there is a real possibility for achieving the project, the developer proceeds, knowing that much still has to be investigated, and that the effort in terms of time and money may be considerable.

After investigating community acceptance with the appropriate public agencies—planning, zoning, public works, traffic and highways—the developer must investigate possible sources of financing. At this point, there is also the need for preliminary architectural and engineering concepts.

Let us focus on financing. Some developers have access to capital investment money, often in large amounts. Large developers often have long-standing relations with local banks. With that kind of financial backing, the task of such developers is to search for possible projects.

Most developers, however, are not in that position. More often, they conceive of projects and then search for capital. They may have some of their own money to invest, or for small projects, such as a medical clinic, they may be able to assemble a small investment partnership. More likely, they will go to a lender, such as a bank, to seek financing.

In order for a bank to lend money, the bank must be convinced that the investment project is sound. If it is a shopping center or office building, market studies, growth trends, and recent development experience may suffice to be convincing. If the project is very large, the lender may require a commitment on the part of major tenants, such as large firms seeking office space or chain department stores needing a new branch location.

If, as often happens, the lender is a pension fund or insurance company, the same evidence of either a market study or prime tenant, or both, is required.

The financial analysis of a building project, which involves cost and return on investment, is referred to as a "pro-forma." The cost of a building of a certain size and construction type can be reasonably estimated, as previously discussed. That same building can also be estimated to produce a certain annual rent. The "cost of money" (principal and interest payments, or "debt service") must also be considered. Other factors include vacancy rate, operating costs, repair allowance, taxes, inflation, etc., as well as depreciation. Depreciation is based on the idea that a building loses value as it ages, at least from a tax standpoint. In fact, however, the opposite is generally true: a viable building in a good location will probably appreciate in value.

Here enters the complex element of taxes and tax laws. The federal tax laws, particularly, greatly influence the type and volume of building construction in the nation. Depreciation is one of many factors that may make a project financially attractive because depreciation is permitted to be deducted before calculating the taxable profit of a project.

All private investments in construction are made with the idea of making a profit. An individual developer, using personal finances, will only proceed with a project if the developer calculates that the return on investment is favorable, and an investment bank or pension fund investor will do the same. The return on investment must be equal to or greater than the return that the money would make in any other investment of comparable risk—stocks, raw land, a business venture, etc.

Most real estate investment is made for a long period of time, 10 to 20 or more years. In some cases, the actual cash return, or profit flow, may not begin for several years. Some projects may have to be carried for the first few years. The amount of real cash loss (carrying expenditure) or positive cash earnings is referred to as "cash flow."

Some investors invest in projects that have negative cash flow, offsetting the loss against current earnings, in the belief that their real profits will be made in the future.

Another important factor in determining the viability of an investment, also because of federal tax laws, is the capital gains tax, which is a tax on profit from the sale of tangible assets, such as a building.

In the past, capital gains were taxed at a lower rate than wages, interest, and other income. That tended to make the sale of buildings quite profitable after taxes, often soon after they were built, which stimulated construction. The capital gains tax advantage has been greatly reduced in recent years, and its partial restoration continues to be a matter of political debate.

We mention the capital gains tax and depreciation to point out that federal tax laws are a major determinant of building construction intensity. They have become, in many ways, an instrument for modifying economic activity, intensifying or reducing it.

All private for-profit building investment is done with a long-range view. It should also be obvious that a developer, burdened willingly with a considerable entrepreneurial effort at the outset of a project, must control expenses. That puts architects who work for developers in the difficult but well-known position of having to do their work in a highly competitive market, under conditions in which a client seeks to minimize costs, particularly "front end" costs. Consequently, the architect's services are often poorly compensated in this sort of competitive and speculative environment. To improve this situation, some architects take an equity position or part ownership in a project, or even become developers themselves.

An exception is the developer who develops more elegant buildings in order to attract more prestigious tenants. Here a premium of 10 to 15% may be expected to produce a more attractive building. The architects for such projects are likely to be those who are recognized for their design quality and distinction and, on occasion, their ability to attract attention through their work. This has been called "signature architecture." Such architects may design those elements that affect the appearance of a building, the facade and lobby, with the rest done by a conventional architectural and engineering firm.

When a developer has assembled his entire project and secured financing for its construction, the financing is made available in the form of a construction loan. As the project is built, the loan funds are paid out to the contractor, subcontractors, and suppliers. This provides the lender with the opportunity to determine that the work is proceeding properly. When the project is finished, the developer obtains a new loan for long-term financing, to be paid off during the financial life of the building through rental income.

One should also be aware of the term "FF & E"—furnishings, fixtures, and equipment. FF & E refers to the built-in furnishings (counters and cabinets), permanently installed fixtures (toilets and sinks) and equipment (lighting) needed for a building to operate. A moment's thought will reveal a quandary. How can a building be complete without FF & E? Such a building would be only partially built.

The reason for the term FF & E is to differentiate the real costs of a building, usually for budgetary convenience. A building without its FF & E is a structure and shell, including its main electrical and mechanical systems, which is obviously much cheaper than one fully equipped. That equipment, however, is paid for from another budget, which is why FF & E was devised.

Its origins trace back to British public health facilities. One budget provided for the building shell; the other, the FF & E, was the budget for completing the building so that it could be used, paying for much of the expensive finishing required in health facilities. Since then, FF & E has come to be used to reduce apparent building budgets by paying for finishing from a different budget or source.

It is customary in this country for a developer to build a basic building shell, ready to receive a tenant—a retail store operator or a law firm office. The tenant pays for the installation of "tenant improvements"—the finishing walls, floor, partitions, etc. This practice is more valid than FF & E, since the "tenant improvements" are just that, the interior construction unique to the tenant's needs, and subject to removal and replacement by a future tenant.

As for FF & E, it could be properly used in institutional buildings, such as hospitals, laboratories, and libraries, to describe the interior work that allows a building to serve its purpose.

Public Buildings

The financing of public buildings is no less complex than that of private projects.

A public building project starts when a public agency recognizes the need for a new school, county office, court house, etc. The agency itself may act as "owner." More likely, a department of government, often called a GSA or General Services Administration, or a Department of Buildings and Grounds, becomes the "owner" and proceeds much the same way as a private developer.

Studies are done, internally or by an outside consultant, to establish a facility program and cost estimate. A site is chosen, and a project schedule and budget are developed. This work is done to coordinate with the government's fiscal process, in which money for projects is requested and apportioned. If the project is approved in the budget allocation, it moves towards realization.

An architect-engineer firm or team is selected, either through an interview process or through a competitive selection based on design. The design work begins and is developed. When the design is approved, the project is put out to bid, a construction contract is awarded, and construction begins.

The entire process is carefully planned and scheduled, and each step is budgeted separately. Public projects, then, often entail a considerable amount of time, due to the step-by-step approval and budgeting processes. Because of this, and as in private building, an inflation allowance is included in the budget.

The financing for public buildings and facilities is achieved through one or two general methods. The first is to pay for the project out of general tax revenues. Federal government buildings are generally paid for this way, with the government paying for the building, as it is designed and built with operating funds derived from appropriations.

As the size of a government jurisdiction becomes smaller, so does its ability to raise the funds to pay for a building as it is designed and built. The design costs can be paid out of a specific appropriation. But often, the construction cost cannot be paid, simply because the municipality does not have sufficient money in hand. Instead, the municipality may issue a bond to raise money from the investment community to pay for the building. In other words, the municipality borrows money, via a bond issue, to finance the building. The bond is paid back over a prescribed number of years.

Since municipal bonds are generally tax free, interest costs to the municipality are reduced. Such bonds have a lower rate of return than other bonds, but the return to investors is not taxed.

There are two types of municipal bonds: *general obligation bonds* and *revenue bonds.* General obligation bonds are used to finance

the construction of facilities that do not collect revenue, such as schools, roads, parks, etc. The principal and interest on such bonds are paid from tax revenues. Revenue bonds, on the other hand, are used to finance revenue-producing facilities, such as toll bridges, water treatment plants, etc., and the fees collected by such facilities are used to pay back the bonds.

The bonds are sold on the open market through brokers. Municipalities are rated according to their reliability in making bond payments, with a triple-A rating being the highest. A high rating allows a city or public agency to issue and sell bonds readily, and at a favorable rate.

The power of a city to plan and build projects and finance them through bond issues is strictly controlled, usually by the state government. These restrictions limit the types of projects a municipality can build (they must be for community services), as well as the total amount of indebtedness a municipality may incur, known as the debt ceiling. A municipality is, in effect, a regulated public corporation.

One should also be aware of special purpose government agencies that have the authority to build facilities. The federal government's General Services Administration is perhaps the largest building authority in the world. At the state, county, and municipal level, special authorities that have the power to finance and build include agencies which build water and sewer facilities, schools, hospitals, jails, public buildings of all sorts, highways, public transit facilities, port facilities, industrial parks, etc.

Similarly, utility companies, which supply electricity, gas, and telephone services, can be regarded as quasi-public authorities. In effect, they are private companies that provide public services. They are franchised to operate in certain areas and are carefully regulated by public commissions.

Private companies whose purpose is to provide needed facilities for low income persons are another form of public authority. They operate on a non-profit basis and are funded by low-interest tax-free obligations as well as private donations.

In some cases, a special tax may be levied to pay for specific public facilities. For example, a hotel tax can be earmarked to pay for a convention hall, on the theory that the convention hall attracts out-of-towners, who spend money and thereby enrich a city.

The financing and operation of private and public buildings requires skilled management and astute investment strategy. For public facilities, the primary responsibility is to provide an adequate public infrastructure.

The private sector requires skilled entrepreneurship as well as public scrutiny, particularly if investment funds come from government-backed institutions. (The ongoing problems involving savings and loan institutions illustrate all too clearly what can happen when such public scrutiny breaks down.)

Finally, there are projects that society needs and that are best realized by continuous long-term effort. Such projects, which include housing for the elderly and public acquisition of ecologically critical natural areas for preservation, are not financially feasible for the private sector and must therefore be financed through special programs. These essentially involve federal or state underwriting of financing, either through special issue bonds or direct financing. Projects of this kind provide long-term benefits to society and therefore represent an investment in the nation's future.

SUMMARY

Budgeting is an essential element of building design and project development. An architect must be aware of the probable cost of the architect's design, from the earliest conceptual stages through design, with ever-increasing accuracy.

Several techniques are used in cost estimating—cost by building type, square footage cost in relation to quality of construction, and analysis by individual building elements.

In addition to the direct cost of construction, there are other costs such as professional fees, permit fees, contractor profits, contingency and inflation allowances, and financing costs.

Finally, it is also necessary to understand both the differences and similarities in funding private and public projects.

LESSON 7 QUIZ

1. An owner has established a fixed construction budget for a project. If the lowest project cost estimate exceeds the fixed budget, the architect should recommend that the owner do any of the following EXCEPT

   A. decrease the size or quality of the project.

   B. postpone construction until costs decline.

   C. rebid the project using other contractors.

   D. increase the construction budget.

2. If you were the architect for the project in the preceding question, your obligation would be to

   A. reduce the quality of construction so that the size and budget would remain unchanged.

   B. reduce the size of the project so that the quality and budget would remain unchanged.

   C. try to convince the owner to reduce the scope or increase the budget so the quality of the project would remain unchanged.

   D. advise the owner of the situation and allow the owner to determine whether cost, size, or quality should be modified.

3. During excavation of a site, it is discovered that unanticipated adverse geological conditions will add at least 10% to the total building cost. The architect should advise the owner to

   A. stop work until additional funds are secured.

   B. stop work and attempt to find an alternate site.

   C. make a change in the cost, scope, or quality of the project.

   D. reduce the project scope and quality in equal proportions.

4. Construction costs are significantly influenced by which of the following? Check all that apply.

   A. Project location

   B. Rate of inflation

   C. Skill of the estimator

   D. Availability of labor

   E. Availability of construction funds

5. An estimate indicates that an apartment project can be constructed for $80 per square foot at today's construction costs. The cost index used for the estimate is at 850. To determine the actual cost, you project the index to reach 1,020, at which point the actual construction cost will be _____ per square feet.

6. In a preliminary project budget, off-site development costs would include

   A. all access roads.

   B. all accessory buildings.

   C. fences placed on property lines.

   D. utilities outside of property lines.

7. The contractor's profit is computed by multiplying a fixed percentage by the

   A. cost of construction.

   B. cost of construction and professional fees.

   C. total project development cost.

   D. total project development budget.

8. Construction cost estimates prepared during the programming phase should be

   A. based on appropriate unit costs.

   B. based on a single lump-sum figure.

   C. disregarded, because there are so many unknowns.

   D. disregarded, because costs do not affect programming.

9. Which of the following statements regarding the tendencies of labor costs are TRUE?

   I. Labor costs in rural areas tend to fluctuate more than in urban areas.

   II. When construction activity is high and labor is scarce, wage rates tend to increase.

   III. Wage demands tend to increase as interest rates rise.

   IV. Wage demands tend to increase as unemployment rises.

   A. I and IV
   B. I and II
   C. I, II, and III
   D. II, III, and IV

10. Which of the following construction costs would a contractor be unlikely to pay?

    A. Topographic survey fee

    B. Building permit fee

    C. Workers' compensation insurance

    D. Labor and material bond

LESSON EIGHT

CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

INTRODUCTION

Application of these principles are covered in Lesson 10, "Construction Contract Administration."

The general conditions of a construction contract between an owner and contractor establish the legal basis for constructing a project. AIA Document A201, General Conditions of the Contract for Construction, is the most widely used form of this kind for private construction projects. It is a complex

and extensive document, and often provides the basis for a number of questions on the exam.

Remember two basic things about AIA A201:

1. It is general and covers items that are common to every project. It must, therefore, be tailored to meet the needs of a specific project by supplementary or special conditions.
2. It forms a part of the owner-contractor agreement, which is a contract between those parties only. The architect is not a party to that contract and is not permitted to prepare it. Only an attorney is authorized to prepare such a contract.

The architect should forward all legal contract forms to the owner. These documents must be reviewed by the owner's attorney and incorporated into the Project Manual after written instructions have been received from the owner. Architects should never act unilaterally concerning general, supplementary, or special conditions of the construction contract.

PRACTICE OF ARCHITECTURE VS. PRACTICE OF LAW

Many owners and their attorneys seek advice from architects on construction contracts. Architects must restrict such advice to technical matters within their training and experience. An architect should not prepare construction contracts or apply the law to specific contractual matters. These are duties of the owner's attorney.

The AIA has produced a series of standard documents intended for use on construction projects. Although architects frequently advise clients that AIA documents should be used, only an owner and his or her legal counsel can decide if the AIA documents are appropriate for a specific project.

CONDITIONS OF THE CONTRACT

Standard Form of General Conditions

Building construction is a complex undertaking involving many parties who often have not previously worked together. These parties join to build a structure on a unique site under environmental conditions that are sometimes difficult. They need a fair and comprehensive set of rules to establish and govern their relationship.

The conditions of the contract establish rules that are consistent from project to project. They deal with contractual matters, not with procedural requirements necessary to administer a contract. Although the general conditions are extensive, there may be supplementary and special conditions required to cover unique situations. Together, all of the conditions expand upon the basic agreement between owner and contractor.

A number of organizations individually publish standard forms of general conditions. AIA Document A201, the General Conditions, has the longest history. It was first published in 1911, and has since undergone many revisions. It represents the careful work of many knowledgeable and experienced people. No one individual can be expected to create a set of general conditions that matches the collective wisdom contained in this standard document. It also has a history of interpretation. Its language has been tested and its meaning determined by the courts. Experience has shown the AIA General Conditions to be generally fair and equitable.

People in the construction industry are familiar with the format of A201. Contractors understand the meaning of the terms in this document and

the consequences of working under it. Standard documents inspire confidence, which is often reflected in bid prices that are not inflated to cover unknown contingencies. These advantages can be significantly diluted if the documents are printed in a new format for each project, even if copied verbatim from standard forms.

Supplementary General Conditions

Standard documents are general and therefore cannot possibly address the exact requirements of each project. Supplementary general conditions are used to modify the standard forms. They accommodate the legal, physical, or climatic conditions of the specific project, usually following the format of the general conditions and paralleling its provisions. New items can be inserted, and other items revised or deleted according to the requirements of the project.

Why not reformat the general conditions with all modifications integrated into the text? This might be practical if standard forms were not so widely known and accepted. But since they are, it is much easier and more efficient for a contractor to read the supplementary conditions to determine what is unique about the project.

Supplementary conditions are particularly important on projects with multiple prime contracts, phased or fast-track construction, or a contract price based on cost plus fee or any method other than a stipulated sum. Standard general conditions alone are not intended to cover such situations.

Special Conditions

Special conditions are used when supplementary conditions must be further extended. For example, when governmental agencies require that their standard conditions be incorporated into a contract, special conditions may be used. Local laws or customs may also require special conditions.

RELATION TO DIVISION ONE—GENERAL REQUIREMENTS OF THE SPECIFICATIONS

The general, supplementary, and special conditions of the construction contract have a legal and contractual purpose. They establish rights and responsibilities of the parties, which are consistent from project to project.

The conditions do not establish administrative procedures. Such procedures are found in the General Requirements division of the specifications. For example, the AIA General Conditions (Document A201) establishes the contractor's legal obligation to review shop drawings prepared by subcontractors. The contractor must approve such shop drawings and point out any deviations from the contract documents prior to submitting them to the architect. The General Requirements division of the specifications defines the specific procedures that a contractor must follow with regard to that obligation. For example, the General Requirements might state that six sets of prints and one reproducible copy of each shop drawing must be submitted. Likewise, if shop drawings must be sent to the attention of a particular person or department in the architect's office, this requirement is also stated. A duty is established in the General Conditions, and a means for discharging that duty is defined in the General Requirements division of the specifications.

RELATION TO LAWS, CODES, AND STANDARDS

Construction contracts are subject to the laws in effect at a project's location, which may supersede specific contractual provisions. While contracting parties establish legal provisions that deal strictly with their own relationship,

they cannot establish or modify provisions that involve the government or other third parties.

For example, an owner and contractor may agree to limit the amount of damages that the contractor will pay the owner if construction is not completed on time, but they cannot agree to limit their legal liability to a pedestrian who is injured while walking past the construction site. Building codes and zoning ordinances also regulate aspects of construction processes. Contracting parties do not have the right to agree between themselves to do less than the minimum required by such codes and ordinances.

RIGHTS AND OBLIGATIONS OF THE OWNER

An owner has both implicit and explicit rights and obligations relative to construction projects. Under the law, owners implicitly promise that contractors will have access to the construction site. Contractors are also entitled to assume that owners will cooperate and not interfere with construction work.

Other rights and obligations of owners are explicitly stated in the general conditions. An owner's principal obligation is to pay the contractor. The AIA General Conditions requires an owner, upon request, to provide evidence that money is available to make payments.

Owners also have obligations related to the property on which a project will be constructed. For example, an owner must provide required surveys, legal descriptions of the site, and easements if necessary.

An owner is required to provide the contractor with as many copies of the drawings and specifications as are reasonably necessary during the construction period. According to AIA standard contracts, the architect owns such documents, and the contractor must return them or suitably account for all sets given during this time.

Article 6 of the AIA General Conditions discusses an owner's right to perform construction work on a project or to hire more than one contractor at the same time. The article also contains provisions by which multiple prime contractors can perform work simultaneously.

Under certain circumstances, an owner has the right to order a contractor to stop the work. This may occur if construction is determined to be defective or not being performed according to the contract documents. If a contractor does not correct mistakes or does not make proper progress on a project, an owner has the right to have the work corrected or completed by others.

OWNER'S RELATIONSHIP TO SUBCONTRACTORS

The AIA General Conditions assumes that there will be one prime, or general, contractor on a project. While much of the construction work is typically subcontracted, the construction contract is between the owner and the general contractor. In this regard, subparagraph 1.1.2 of the AIA General Conditions (Document A201) clearly states that nothing in the contract documents creates a contractual relationship between an owner and any subcontractor or sub-subcontractor.

Although there is no contractual relationship, there is an implied relationship between an owner and subcontractors. The General Conditions requires a general contractor to bind all subcontractors to the same terms and conditions that bind the contractor to the owner. It

also requires that subcontractors have the same rights relative to the contractor that the contractor has relative to the owner. The General Conditions extends rights and responsibilities from owner to contractor to subcontractor and creates the context for all contractual relationships on a project.

SEPARATE PRIME CONTRACTS

Special attention must be paid to supplementary conditions on projects where there will be more than one *prime contractor*. A prime contract is one executed between owner and contractor. *Separate prime contracts* may be used if an owner wants to, or is required by law to, contract directly with several contractors. Separate prime contracts may be written for structural, HVAC, plumbing, electrical, or other major portions of the work.

In this event, each set of contract documents requires its own agreement, conditions, drawings, specifications, and so forth, and there is no single contractor responsible for the whole project. Each contractor is responsible for his portion of the construction work and to coordinate with the others.

Problems frequently arise when one contractor delays or damages another contractor's work. Other problems of a minor nature may also occur. For example, general clean-up may be neglected while other construction details may be needlessly duplicated. Many contractors could, for example, use the same scaffolding if there were adequate coordination. Such problems may be solved in several different ways: a *construction manager* may be retained to provide coordination services, the owner may have a staff capable of the task, or administrative and supervisory responsibilities may be assigned to one of the prime contractors.

MAJOR ELEMENTS OF THE CONDITIONS

Bonds

The AIA General Conditions (A201), Paragraph 11.4, gives owners the right to require the contractor to provide bonds assuring that contract work will be performed in accordance with the contract documents. These bonds also guarantee that obligations arising out of the contract will be paid or satisfied. Bonds reduce an owner's risk of financial loss if a contractor defaults in performance or does not pay the bills.

Bonds referred to in the General Conditions include the Performance Bond and Payment Bond. Refer to AIA Document A312. They are usually written for the full amount of the construction contract.

Bonds are provided by *surety* companies that guarantee that the contractor (the *principal* or *obligor*) will fulfill the contractual duties to the owner (the *beneficiary* or *obligee*).

Contractors are usually required to furnish a bid bond, Document A310, on most competitively bid projects. Bid bonds are usually written for 5 or 10% of the bid amount. If the low bidder refuses to sign a contract for the amount bid, the surety partially or fully compensates the owner for the difference between the low bid and the actual contract price of the substituted contractor.

Insurance

Owner's

Paragraph 11.3 of the AIA General Conditions states that an owner must purchase property insurance for the full insurable value of construction work. The insurable value of a project is usually less than the construction

contract sum because certain elements of the contract, such as earthwork and grading, are not included. Owners must also purchase boiler and machinery coverage if required.

Property insurance is commonly referred to as *builder's risk* insurance. It includes fire and property damage insurance for a project during construction. It also covers temporary structures, materials, equipment, and supplies, and usually covers tools and equipment if they are located within 100 feet of the project site, as well as property in transit or stored off-site.

The General Conditions usually requires that builder's risk coverage be the *all risk* type, which provides broader coverage than standard *named peril* forms. All risk covers everything but specified exceptions, while named peril insurance only covers risks that are specifically identified.

Property insurance must include riders for extended coverage, including theft and vandalism and malicious mischief. None of these riders includes coverage for earthquake or flood damage. These coverages must be purchased separately.

Since title to construction work passes to the owner upon incorporation of that work into the project or upon payment for it, the AIA General Conditions provides that owners, not contractors, purchase property insurance. If the owner wants the contractor to purchase property insurance, the General Conditions may be modified by appropriate provisions in the supplementary conditions.

Property insurance will be cancelled if an owner occupies all or part of a project prior to substantial completion without the insurance company's consent. Partial occupancy of a project is relatively common and insurance companies must therefore be notified if coverage is to remain in effect.

All coverages mentioned must include the financial interests of contractors and subcontractors, as well as those of owners. For example, a contractor may have paid for materials that are on-site, but which have not been incorporated into the project. If these materials are destroyed, the contractor will have an interest in money paid by the insurance company to cover the loss. The General Conditions provides that the owner will act as trustee for the proceeds paid by insurance companies.

Finally, an owner may purchase *loss of use* insurance that protects against losses arising out of delays or other events that prevent an owner from using a project when and as intended.

Contractor's

The AIA General Conditions also requires contractors to purchase certain types of insurance. Paragraph 11.1 lists required coverages that include the following:

1. *Workers' compensation* insurance. Covers job-related injuries and is usually required by law, which also sets required limits.
2. *Liability* insurance. Covers claims for damages for bodily injury, sickness, disease, or death of the contractor's employees or any other person.
3. *Personal injury* insurance. Covers libel, slander, false arrest, and defamation of character.
4. *Property damage* insurance. Intended to cover property, other than construction work itself, which may be damaged by construction activities. Usually, explosion, collapse, and underground damages are excluded and must be added by endorsement if required.

5. *Automobile liability* insurance. Covers claims for damages arising out of the use of an owned, non-owned, or hired automobile.
6. *Contractual liability* insurance. Covers liability assumed by contract. Under Paragraph 3.18 of the AIA General Conditions, this is primarily *indemnification*, wherein contractors agree to hold owners and architects harmless from damages arising out of specified events.

AIA Document G715, Certificate of Insurance, summarizes the insurance coverage required under the general conditions of the contract.

Contractors are usually required to obtain *products and completed operations* coverage. This insurance covers claims for bodily injury or property damage arising from accidents that may occur after the construction work has been completed and turned over to the owner. However, completed operations insurance does not apply to damage of the completed work itself.

All required coverages, in amounts specified in the supplementary conditions, must be purchased prior to starting construction work, and certificates of insurance must be provided to the owner and the contractor. The certificates must state that the insurance company will notify all parties in advance if insurance is going to be cancelled for any reason.

Liens

Mechanics' liens exist by statute in each state to provide security for payment for labor and materials supplied to construct buildings.

Such liens apply only to the real property in question, buildings and land, and not against other assets of the owner. Liens give the worker, contractor, or material supplier the right to force the sale of an owner's property in order to satisfy a claim for payment. Lien rights give contractors leverage over an owner to force payment of legal claims because valid liens encumber an owner's title to the property. Without clear title, an owner may be prevented from transferring the property through sale or other means.

Liens were devised to encourage people to supply labor and materials for construction projects. Lien laws may seem unfair from an owner's point of view because subcontractors and suppliers who have not been paid by a general contractor may file liens against an owner even if the owner has paid the general contractor for their work.

However, liens are basically fair and equitable since, in most cases, it is impossible to repossess labor and materials that have been incorporated into a construction project.

The AIA General Conditions addresses liens in two places. In subparagraph 9.3.3, the contractor warrants that all labor, materials, and equipment for which payment is requested are free of liens and claims of every kind. Subparagraph 9.10.2 states that final payment will not be made until the contractor submits an affidavit that all debts arising out of the project for which the owner or the owner's property may be liable have been satisfied. The owner may also ask for releases and waivers of liens from the contractor and subcontractors, though sometimes a bond is acceptable in lieu of such waivers.

Liens are not permitted on publicly owned projects. Instead, labor and material payment bonds provide the necessary protection. The Federal law requiring such bonds is known as the *Miller Act*, and many states have similar laws, referred to as *little Miller Acts*.

Details related to these matters vary considerably, depending on the jurisdiction in which

the project is located, and the owner's attorneys should respond to questions about liens. Architects should not advise owners on the legal sufficiency of required affidavits, waivers, or releases of liens.

Shop Drawings and Submittals

Improper processing of submittals by the contractor and architect may result in controversy, delays, additional costs, and even litigation.

Responsibility of the Contractor

Paragraph 3.12 of the AIA General Conditions defines a contractor's responsibilities concerning shop drawings. The contractor must review, approve, and promptly submit shop drawings required by the contract documents.

A contractor's stamp of approval on shop drawings means that the contractor will or has *determined and verified materials, field measurements, and field construction criteria related thereto, or will do so, and has checked and coordinated the information contained within such submittals....* Because contractors have this obligation, architects should *not* review shop drawings unless they contain such a stamp of approval.

The General Conditions prescribes that the contractor is responsible for errors or omissions in shop drawings. Deviations from the requirements of the contract documents are not considered approved by the architect simply because they appear in approved shop drawings. If there are proposed deviations, they must be called to the architect's attention in writing and approved in writing before they become effective. Similarly, if there are revisions to resubmitted shop drawings, other than those revisions requested by the architect on the prior submittal, they must specifically be called to the architect's attention or they will not be effective.

Responsibility of the Architect

The architect's responsibilities are primarily described in the owner-architect agreement. Those described in the AIA Owner-Architect Agreement (Document B102 or B201) are restated in the AIA General Conditions (Document A201) for the contractor's information. If Document B102 or B201 is not used, contractors may not know what services the architect is obligated to provide.

Architects must promptly *review and approve or take other appropriate action* on shop drawings that contractors submit. The General Conditions clearly states that review is strictly to determine if shop drawings conform to the design concept and information given in the contract documents. Matters outside the scope of the design concept and the contract documents are not reviewed.

An architect may be reluctant to use the word *approved* when acting on a submittal because some professional liability exposure may be perceived. However, the AIA General Conditions and the AIA Owner-Architect Agreement both limit the architect's duty with regard to submittals, which results in limited liability exposure. As with other duties, if the architect has performed services in accordance with these AIA documents and within a *standard of care*, there should be no concern about professional liability.

In addition to *approved*, other appropriate action that an architect can take includes *approved as noted, revise and resubmit*, and *not approved.*

Time Limits, Schedule, and Delay

The General Conditions, particularly Article 8, contains many provisions related to timely completion of the work. For example, contractors must complete construction work in the

allotted number of calendar days. Calendar days (7 days per week), as opposed to working days, are used to preclude questions about how to count weekends and holidays.

Contract time may start on the date of signing the owner-contractor agreement, upon the issuance of a formal notice to proceed, or on another date stated in the owner-contractor agreement. Contract time ends when construction work is substantially complete. If an owner anticipates a financial loss if the project is not completed on time, and if the owner's attorney recommends the inclusion of a provision for *liquidated damages*, such a provision is included in the owner-contractor agreement. Liquidated damages is an amount of money stipulated in the contract that is chargeable against the contractor as reimbursement for damages suffered by the owner because of the contractor's failure to fulfill contractual obligations.

According to subparagraph 8.2.1 of the *AIA* General Conditions, time limits are *of the essence of the contract*. This term has a special legal meaning. When timing is not crucial, there is no breach of contract as long as work or services are completed reasonably close to anticipated deadlines. However, when *time is of the essence*, even a slight delay may constitute a breach of contract.

The contractor is required to prepare and submit a progress schedule, showing how the work is to be completed within the contract time. On small projects, a bar chart, also known as a Gantt chart, is often used. On large or complex projects, a *critical path method (CPM)* schedule is usually required. The CPM schedule is computerized and differs from a bar chart because it shows relationships between activities, not just durations and sequences.

The General Conditions also provides for extensions to the contract time if an owner's actions or inactions delay a contractor. Changes to required work may also justify time extensions. The General Conditions provides for events of *force majeure*, or acts of God, that are beyond the control of either party. If any delays of this kind occur, the contractor must notify the architect within 21 days or the claim for time extension is waived. The contract time may only be changed by change order or construction change directive.

All of the delays mentioned above may result in an extension of time to complete the contract work. Without this extension, a contractor might be assessed monetary damages for late completion. On the other hand, the contractor may claim monetary damages because of delays allegedly caused by the owner or architect. Time extensions, however, do not automatically entitle the contractor to monetary damages. Standard AIA documents provide means by which a contractor may make a claim for time extensions, monetary damages, or both. Supplementary conditions often contain detailed provisions related to scheduling and the consequences of delays.

Payment Procedures

Prior to submitting the first *application for payment*, the contractor is required to submit a *schedule of values* for all parts of the construction work. This schedule is the basis for the contractor's subsequent applications for payment.

When reviewing the contractor's proposed schedule of values, the architect must determine that appropriate values are assigned to each portion of the work. Usually the contractor is entitled to initial payment for site mobilization, preparation of submittals, and other work that is not actual construction. However,

the contractor may *front load* the schedule of values by overstating the value of materials and understating the value of labor. In that event, after the materials are delivered and paid for, the payment for the labor required to install the materials may be inadequate. Of course, the contractor must still pay the labor charges. In the worst case, if the contractor defaults and has unpaid bills from subcontractors or suppliers, the owner may be exposed to financial loss. The architect can protect the owner from such exposure, and save the owner from unnecessarily advancing funds to the contractor, by carefully reviewing the contractor's schedule of values.

Prior to each progress payment, the contractor must submit an application for payment for the architect's review. On the basis of the application, the contractor will generally be paid for all materials and equipment incorporated into a project and for all materials and equipment stored on-site. Special provisions must be made if the contractor requests payment for materials and equipment stored off-site or in transit.

The contractor must also warrant that the owner will obtain title to materials and equipment free and clear of liens and claims. This guarantee becomes effective either upon their incorporation into the project, or payment by the owner in the case of stored materials and equipment.

The architect reviews the contractor's applications for payment and assesses the progress of the construction work. Each application must be based on the approved schedule of values. For example, a typical entry on an application for concrete work with a total value of $60,000 might be for 50% completion less 10% retainage, for a partial payment of $27,000 ($60,000 × 50% × 90%), less amounts previously paid. In that case, the architect must determine if 50% of the concrete work is actually complete, and that the retainage figure is correct. Each line item must be similarly analyzed.

Architects have the right to certify that *no* payment, or an amount less than that requested by a contractor, is due. This action might be necessary if the work has not progressed as claimed by the contractor or if it is not completely acceptable.

Architects also have the right to nullify all or part of previous certificates for payment if it is necessary to protect an owner against

- defective work that has not been corrected;
- claims, or the likelihood of claims, by third parties;
- a contractor's failure to pay subcontractors;
- evidence that the contract work cannot be completed for the unpaid balance of the contract sum;
- damage to the owner or another contractor;
- evidence that the contract work cannot be completed on time; or
- a contractor's persistent failure to comply with contract documents.

When an architect issues a certificate for payment, an owner must pay the contractor as stipulated in the contract documents.

Once a contractor has received payment, all subcontractors must be paid proportionately. Similarly, the amounts of money retained by the contractor from payments to the subcontractors must be in proportion to the amounts retained by an owner. Subparagraph 9.6.3 of the AIA General Conditions states: "The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor."

It is solely the contractor's responsibility to pay subcontractors. Neither the owner nor the architect has an obligation to ensure that subcontractors are paid. The architect is not responsible for the contractor's disposition of funds paid as a result of applications and certificates for payment.

Finally, the General Conditions states that nothing in the payment process shall be construed as acceptance of work not performed in accordance with the contract documents. Acceptance is determined by provisions for final payment, correction of work, and warranty.

Safety

Contractors are responsible for safety precautions and programs relative to construction work. This includes the safety of the contractor's employees, the construction work itself, and adjacent property that is not part of the construction work.

If damage is caused by a contractor, subcontractor, or other entity for which a contractor is responsible, the contractor must repair or pay for it. Normally, a contractor's superintendent is the individual responsible for construction site safety. In case of emergency, the superintendent may act in any reasonable manner to prevent loss of life or damage to property. If such action or inaction delays work or increases costs, the contract time and contract sum may be changed appropriately by change order.

Since safety is the contractor's obligation, an architect should not review or enforce safety programs or procedures. If an architect notices an unsafe condition, however, the condition should promptly be reported to the contractor's superintendent, and a written record of the circumstances should be prepared. Contractors are the appropriate parties to decide what actions, if any, are required to remedy unsafe conditions. It is improper for an architect to approve or order changes to a contractor's safety programs. Such involvement may create liability for the architect should an accident occur on the site.

Substantial Completion

Legal Effect

In general, contracts must be *completely* performed. Anything less than completeness may be interpreted as a breach of contract. In fact, however, neither the owner nor the contractor would benefit from such a strict definition of completion. Therefore, the law recognizes *substantial completion*, which is sometimes called *substantial performance*. Once a construction contract is substantially complete, a contractor is entitled to the contract sum, less the value of incomplete work and retainage. Upon *final completion*, the contractor is entitled to final payment.

Under the AIA General Conditions, the contract time is the period allotted for substantial completion, including authorized adjustments. Warranty periods begin upon substantial completion. In cases where there are separate prime contracts or phases of construction, there may be more than one date of substantial completion, and more than one warranty period.

Paragraph 9.8 of the AIA General Conditions explicitly defines the *date of substantial completion* and describes its significance. Although the date on which the code official issues a certificate of occupancy is often the same as the date of substantial completion, this is not necessarily the case. For example, a given contract might entail a great deal of finish work that is not required for a C of O but essential to substantial completion. All of the requirements of the contract must be substantially performed to achieve substantial completion, mere occupancy is not sufficient.

The AIA Certificate of Substantial Completion (Document G704), when signed by the owner, architect, and contractor, establishes the date of substantial completion and the responsibilities of each party.

Role of the Contractor

Paragraph 9.8 of the AIA General Conditions discusses the requirements for the date of substantial completion. It is the contractor's responsibility to decide when a project is substantially complete. According to the contract documents, this occurs when the owner can occupy or use the project for its intended purpose. At that time, the contractor prepares a list of items to be corrected and those that must still be completed. That list is submitted to the architect, and a date is set for the architect's inspection. The contractor's list of items may not be definitive, and it is of no legal consequence if items are omitted. The contractor is still required to comply with the contract documents. However, such a list is helpful to the architect performing an inspection.

Role of the Architect

According to the AIA Owner-Architect Agreement, an architect *inspects* a project at only two points in the construction process—substantial completion and final completion. All other site visits are "to become generally familiar with and to keep the Owner informed about the progress and quality of the Work..." Such visits are less detailed and comprehensive than *inspections*. Upon being notified by the contractor, an architect schedules an inspection to determine if a project is substantially complete.

The list of items to be completed or corrected is provided by the contractor and is usually expanded by the architect as a result of a detailed inspection. This list is commonly referred to as a *punch list*. At times, additional work is required before an architect is able to certify that a project is substantially complete.

Many architects include provisions in the supplementary conditions requiring the contractor to pay the architect's fee and expenses for subsequent inspection trips if the project is not substantially complete when first inspected.

The certificate of substantial completion establishes the date of substantial completion and states the time within which the contractor must perform the work described on the *punch list*. The certificate also states the responsibilities of both owner and contractor for "... security, maintenance, heat, utilities, damage to the Work, and insurance...."

These items are important because the contractor must continue to work on-site, which usually requires access to substantially completed and occupied portions of a project. Construction workers may damage completed portions of the project, use power and water, and possibly injure themselves or others between substantial and final completion. All such events must be anticipated and responsibility for the consequences predetermined.

Role of the Owner

The owner, the contractor, and the architect must sign the certificate of substantial completion. By doing so, they indicate their acceptance of the responsibilities assigned in it.

At substantial completion, the full contract sum, less the value of incomplete work and retained amounts, is normally due the contractor. The amount of retainage may be reduced at this time to reflect the actual value of the work to be completed and corrected.

Insurance

Owners usually occupy projects immediately after the issuance of a certificate of substantial completion. Occupancy invalidates property insurance coverages that were in effect during the construction period. It is important,

therefore, for owners to inform the insurance company and make necessary insurance changeover arrangements prior to occupying any portion of a project.

A contractor's surety has a financial interest in money retained by an owner from amounts due the contractor, since that money can be used by the surety if the contractor defaults. If any portion of the retainage is refunded to a contractor, the surety's risk of loss is theoretically increased. Applicable bonds are voided if retainage is released without the surety's consent.

It is essential, therefore, for an owner to obtain the surety's written consent before any portion of the retainage is released to a contractor. The AIA Consent of Surety to Reduction in or Partial Release of Retainage (Document G707A) is intended for this purpose.

Warranties and Guarantees

Paragraph 3.5 of the AIA General Conditions contains a general warranty for performance from the contractor to the owner and the architect. It states that all materials and equipment are to be new, unless otherwise specifically required, and that completed construction, including workmanship, is to be of good quality and free from faults and defects.

In subparagraph 9.3.3, the contractor warrants that legal title to all materials and equipment will pass to the owner upon its incorporation into construction or upon the contractor's receipt of payment, whichever is earlier. Title must be free and clear of liens, claims, or other security interests. The owner's attorney, not the architect, must determine if that requirement is met.

Since these warranties are governed by state law, their terms may vary. They are generally in force for several years from their effective date. The owner may recover monetary damages from the contractor during the full time the warranty is effective under a state's statute of limitations.

Subparagraph 12.2.2 of the AIA General Conditions states: "If, within one year after the date of Substantial Completion ... any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly...." An owner's right specifically to have defective work corrected by the contractor during the first year after substantial completion is important because most defective work cannot be detached and returned to the manufacturer for repairs.

Specific product warranties are often required in the technical sections of the specifications. Manufacturers, through subcontractors, usually provide warranty certificates prior to substantial completion. The procedure is usually described in Division One.

Record Drawings

Record drawings are sometimes inaccurately referred to as *as-built drawings*. According to Paragraph 3.11 of the AIA General Conditions, contractors are required to maintain copies of all drawings, specifications, addenda, change orders, and other modifications at the site in order to accurately record all changes made during construction. Similarly, they must keep copies of all shop drawings, product data, and samples. These are record drawings.

For example, record drawings might indicate that a door originally intended to be 2'-0" from a corner was installed at 4'-0" from the corner. Architects have occasionally been held liable for what were purported to be as-built drawings when subsequent construction work resulted

in damage to concealed utility lines, structural elements, and so on. No drawings can ever depict all as-built conditions.

An owner may want a reproducible set of record drawings when a project is completed. Supplementary Conditions or Division One—General Requirements of the specifications may require contractors to prepare such a set. If the owner requests the architect to prepare such drawings, it is generally considered a change in services.

Final Completion and Final Payment

When the work noted on the *punch list* is completed, the contractor notifies the architect that the project is ready for final inspection and submits a final application for payment. The architect then inspects the project and if, in the architect's opinion, it is complete in accordance with the contract documents, a final certificate for payment is issued to the owner. This payment represents the entire balance due the contractor including retainage.

Before final payment is made, the contractor must submit

- an affidavit that all debts for which the owner or the owner's property could be held responsible have been satisfied, to avoid the filing of liens or claims;
- written consent of the surety to final payment, to avoid surety bonds being voided; and
- other data such as receipts and waivers that an owner may require to demonstrate that there are no outstanding obligations related to the project.

It is solely the responsibility of the owner and the owner's legal counsel to determine the extent and form of required documents. Architects should not advise an owner on, nor judge the legal sufficiency of, legal documents being submitted for final payment.

The AIA General Conditions, subparagraph 9.10.4, states that, upon making final payment, an owner waives all claims against the contractor except those arising from:

> .1 *liens. Claims, security interests or encumbrances arising out of the Contract and unsettled;*
>
> .2 *failure of the Work to comply with the requirements of the Contract Documents; or*
>
> .3 *terms of special warranties required by the Contract Documents.*

Upon acceptance of final payment, the contractor waives all claims except those made previously in writing and identified as unsettled at the time final application for payment was made.

Project Close-Out

Close-out procedures are more administrative than contractual. Therefore, these procedures are described in Division One—General Requirements of the specifications, rather than in the AIA General Conditions.

To close out a project, the contractor is usually responsible for

- submission of record drawings and specifications as well as maintenance manuals, warranties, and other record information;
- delivery of tools, spare parts, and extra stock of materials;
- removal of temporary facilities;
- start-up testing of equipment, as well as training of owner's operating/maintenance personnel; and
- final touch-up, repairs, and cleaning.

LESSON 8 QUIZ

1. According to AIA documents, which of the following are NOT considered a part of the construction contract documents?

   I. Specifications
   II. Addenda
   III. Shop drawings
   IV. Owner-Architect Agreement
   V. Supplementary Conditions

   A. IV only
   B. II and III
   C. I and V
   D. III and IV

2. _____ assures an owner that the contractor will execute the work in accordance with the contract.

3. During the course of construction, liability insurance should be maintained by which of the following?

   I. The mortgagee
   II. Trade unions
   III. The surety company
   IV. The owner
   V. The contractor

   A. IV only
   B. I and V
   C. IV and V
   D. II and III

4. Where would provisions for liquidated damages normally be found?

   A. Owner-Contractor Agreement
   B. General Conditions of the Contract for Construction
   C. Additive Alternates to the Contract
   D. Proposal Form and Instructions to Bidders

5. A change during construction in the location of underground lines from that shown on the site utilities plan should be reflected in

   A. record drawings.
   B. architectural drawings.
   C. field sketches.
   D. shop drawings.

6. Architects are responsible for preparing which parts of a Project Manual?

   I. Specifications
   II. General Conditions
   III. Supplementary Conditions
   IV. Owner-Contractor Agreement

   A. I only
   B. I and III
   C. II and III
   D. I, II, III, and IV

7. Which of the following are responsibilities of the owner under the provisions of the AIA General Conditions?

   I. Provide access to the construction site.
   II. Make payments to the contractor.
   III. Make payments to the subcontractors.
   IV. Obtain necessary easements.
   V. Provide necessary copies of construction documents.

   A. II only
   B. II and III
   C. I and IV
   D. II, IV, and V

8. Which of the following statements is TRUE? Contract time

   A. is measured in working days.

   B. ends at substantial completion.

   C. ends at final completion.

   D. always starts when the Owner-Contractor Agreement is signed.

9. Under the provisions of the AIA General Conditions, which of the following statements is TRUE?

   A. Warranty periods begin at substantial completion.

   B. Warranty periods begin at final completion.

   C. The general warranty period is one year.

   D. Warranties are worthless without bonds to back them up.

10. An architect issues certificates for payment for work performed by the contractor. For what reasons might an architect legitimately nullify all or part of a previously issued certificate for payment?

    I. The architect discovers defective work.

    II. The owner's lender refuses to release funds.

    III. The contractor fails to pay subcontractors.

    IV. A pedestrian walking past the project site is injured by a falling piece of lumber and sues the owner.

    V. The contractor persistently fails to comply with the contract documents.

    A. I, II, III, IV, and V

    B. I only

    C. I, III, IV, and V

    D. III and V

11. Which of the following statements concerning payments to a contractor is FALSE?

    A. Payments are based on a schedule of values.

    B. Title to materials and equipment passes to the owner upon payment.

    C. The owner must pay the contractor within 21 days after the architect issues the certificate for payment.

    D. Payments do not normally cover materials in transit.

12. Which of the following parties are responsible for workers' safety on a construction site?

    I. The owner

    II. The architect

    III. The general contractor

    IV. The contractor's surety company

    A. III only

    B. I only

    C. I, II, and III

    D. I, II, III, and IV

13. An architect, under the provisions of the AIA documents, inspects a project how often during the construction phase?

    A. Never, the architect observes the construction.

    B. At intervals appropriate to the progress of the construction work.

    C. Once, at final completion.

    D. Twice, at substantial completion and at final completion.

14. Which of the following is NOT a prerequisite for final payment to the contractor?

    A. Final inspection by the architect.

    B. Owner's receipt of the certificate of final completion from the architect.

    C. Owner's receipt of the contractor's affidavit of payment of debts.

    D. Owner's receipt of consent of the contractor's surety company.

15. Which of the following parties must approve shop drawings according to the AIA General Conditions? Check all that apply.

    A. Architect

    B. Contractor

    C. Owner

    D. Engineers

    E. Subcontractors

LESSON NINE

DOCUMENTATION

INTRODUCTION

Construction documents prepared by architects and their consultants consist primarily of drawings and specifications. Architects must understand the purpose of these documents and the conventions used in organizing and producing them.

Drawings and specifications convey the owner's and architect's design intentions to the contractors responsible for bidding and constructing the project. In order to obtain competitive bids from contractors and to enable construction to proceed with a minimum number of changes and conflicts, the construction documents must be complete, concise, correct, clear, and coordinated. If, because of negligence by the architect and/or the architect's consultants in preparing the construction documents, the construction budget is exceeded, or an inordinate number of

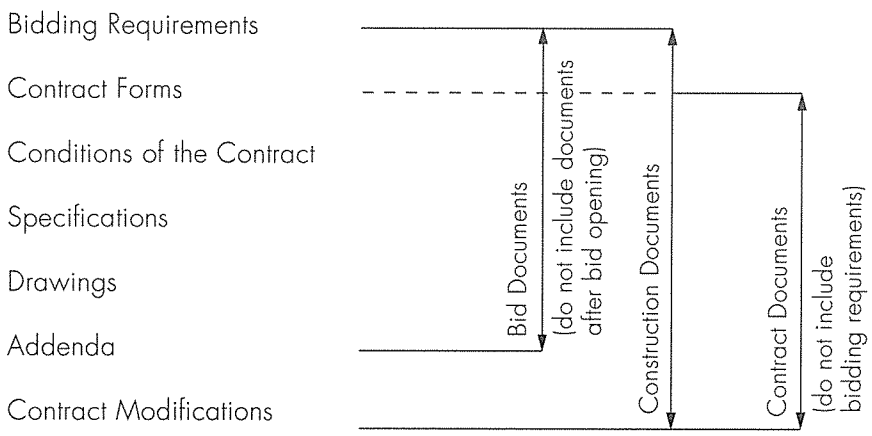


Figure 9.1

change orders are required during construction, the architect may be subjected to professional liability claims.

The building industry has developed standards for construction documents to achieve these objectives. Architects who have a clear understanding of these standards will be prepared to communicate with consultants and contractors and to objectively review and evaluate their work.

CONSTRUCTION DOCUMENTS

"Construction Documents" is a term used to describe many types of documents used to take a project from design to completed building. Figure 9.1 lists types of construction documents.

Correlation between Drawings and Specifications

Drawings and specifications must be consistent with each other to avoid misinterpretation. Drawings define physical relationships between materials, products, and systems. They indicate physical dimensions and locations of construction elements. Sizes, quantities (implicitly), and configurations are all shown on drawings. Specifications complement the drawings. They express in writing the requirements regarding quality, methods and techniques of installation, and desired performance. For an example of the coordination of drawings and specifications, see Figure 9.2.

Reference noting systems, which use specification section numbers in the drawing notes, can enhance coordination between drawings and specifications.

Construction Drawings

Logic

Although drawings may be organized somewhat differently for each project, they usually communicate their intent most effectively when recognizable and accepted conventions are used, such as standard abbreviations, material designations, graphic symbols, and schedule formats.

The drawings must also be organized logically. Sheets that define symbols and abbreviations or contain other general information are usually placed first in a set of drawings, followed by site and landscape drawings, architectural drawings, structural, plumbing, HVAC, and electrical drawings. Consistent use of this arrangement makes it easier for contractors and others to locate needed information. For an example of the typical sequence of drawings, see Table 9.1.

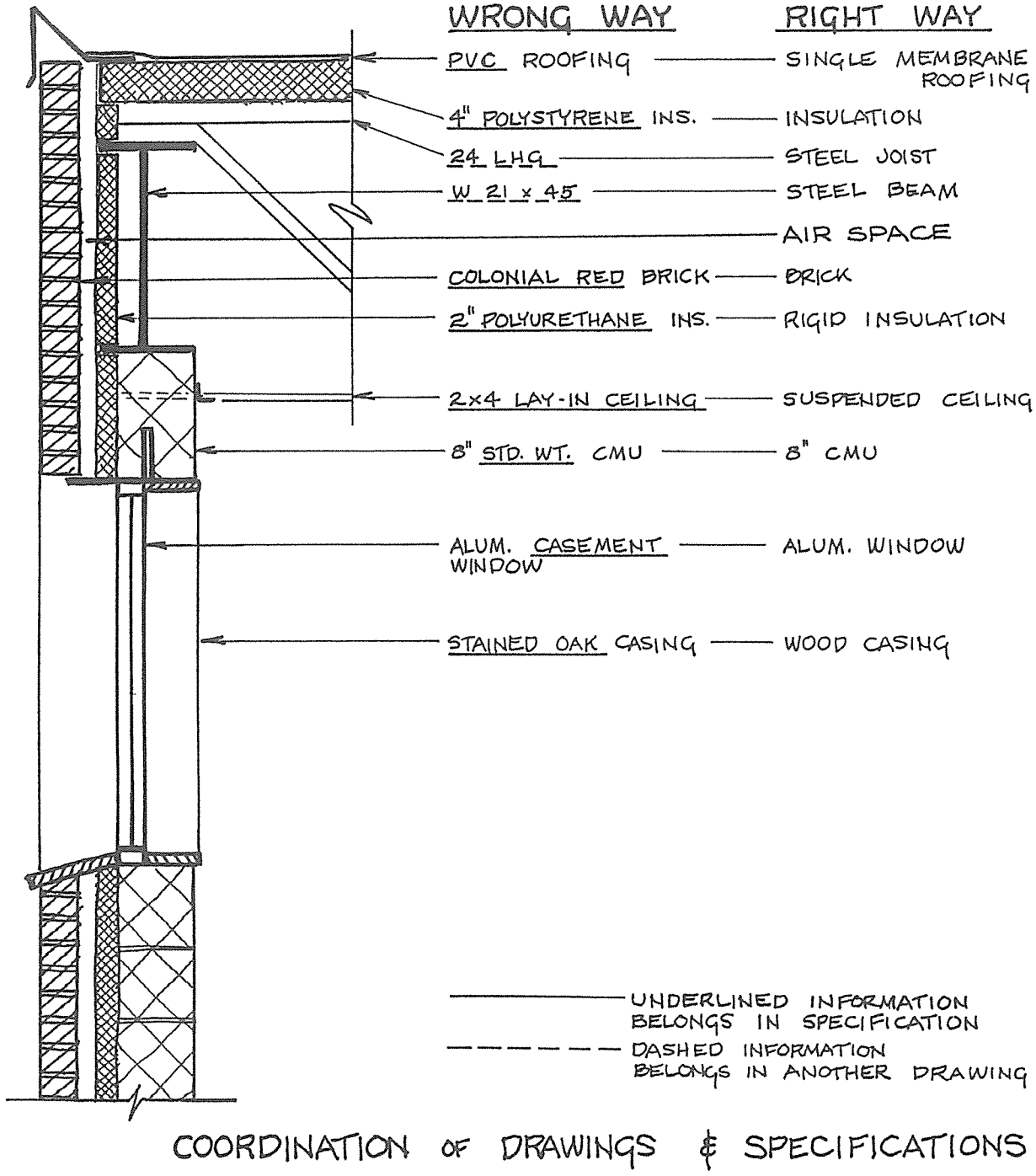

WRONG WAY
RIGHT WAY
PVC ROOFING
SINGLE MEMBRANE ROOFING
4" POLYSTYRENE INS.
INSULATION
24 LHG
STEEL JOIST
W 21 x 45
STEEL BEAM
AIR SPACE
COLONIAL RED BRICK
BRICK
2" POLYURETHANE INS.
RIGID INSULATION
2x4 LAY-IN CEILING
SUSPENDED CEILING
8" STD. WT. CMU
8" CMU
ALUM. CASEMENT WINDOW
ALUM. WINDOW
STAINED OAK CASING
WOOD CASING
UNDERLINED INFORMATION BELONGS IN SPECIFICATION
DASHED INFORMATION BELONGS IN ANOTHER DRAWING
COORDINATION OF DRAWINGS & SPECIFICATIONS

Figure 9.2

TYPICAL SEQUENCE OF DRAWINGS

Title Sheet, including list of drawings, list of abbreviations, material and symbol schedules, and general notes

Architectural Drawings
- Code compliance diagrams
- Site plan, including vicinity map
- Site details
- Landscape plan(s) and details (if required)
- Demolition plans (if required)
- Floor plan(s)
- Exterior elevations
- Building sections
- Wall sections
- Stair and elevator plans, sections, and details
- Supplementary plan(s) and details of special facilities (if required)
- Exterior details
- Window types
- Window details
- Interior elevations
- Interior details
- Millwork details
- Finish schedules
- Door and frame schedule and details
- Reflected ceiling plan(s)
- Roof plan(s)
- Miscellaneous details

Structural Drawings
- Foundation plan(s)
- Floor framing plan(s)
- Roof framing plan(s)
- Structural sections
- Structural details
- Schedules, including footings, beams, joists, and columns

Plumbing Drawings
- Site plan
- Plumbing plans
- Fire protection plans (if required)
- Plumbing details
- Plumbing schedules, including plumbing fixtures
- Riser diagrams

(continued)

Table 9.1

TYPICAL SEQUENCE OF DRAWINGS
Heating, Ventilating, and Air Conditioning (HVAC) Drawings
HVAC plan(s)
HVAC details
HVAC schedules
Riser diagrams
Electrical Drawings
Site plan
Electrical plan(s), including power and lighting
Single line diagrams
Electrical details
Electrical schedules, including lighting fixtures
Information Technology or Telecommunications Drawings

Table 9.1 (continued)

TYPICAL PROJECT MANUAL CONTENTS	
Title Sheet	
Signature Sheet	
Table of Contents	
Bid Form	
Instructions to Bidders	
Proposed Owner-Contractor Agreement	
General Conditions and Supplementary Conditions	
Sample Forms	
AIA Document A312	Performance Bond and Payment Bond
AIA Document G702	Application and Certificate for Payment
AIA Document G703	Continuation Sheet
AIA Document G704	Certificate of Substantial Completion
AIA Document G707	Consent of Surety to Final Payment
AIA Document G707A	Consent of Surety to Reduction in or Partial Release of Retainage
List of Drawings	
Index to Specifications	
Specification Divisions 1 through 16	

Table 9.2

Clarity

Since the purpose of drawings is to convey information to contractors and others, architects must present the information clearly, accurately, and at appropriate scales. If drawings are not sufficiently clear or complete, they will generate questions or unintended results. If they are inadequately dimensioned, inaccurate, or are drawn at inappropriate scales, they are likely to cause errors in the field, and possibly additional costs or delays.

Clarity is a result of common sense and coordination. Redundancy, ambiguities, and omissions must be avoided. Each item should be explained and drawn with adequate detail and placed in the most logical location in a set of drawings. Graphic symbols, designations, and cross-references are often necessary. Using cross-references reduces the amount of drawing that must be done, and subsequent revisions only need to be made once.

It is essential that the construction documents clearly delineate the scope of work required for the project. Generally anything shown on the drawings is part of the scope of work. However, there are several important exceptions to this general statement. For example, on site drawings, the surroundings are usually shown. To delineate the scope of work required by the contract, a limit line must be drawn. For utilities, a point of connection must be shown. For renovations or additions, the existing conditions are usually shown. The drawings must indicate, by graphic and written notation, the existing construction to remain, the existing construction to be removed, and the new construction. Equipment or other items furnished by the owner may be shown on the drawings to establish dimensional criteria. These should be noted as not-in-contract (NIC).

Relation to Shop Drawings, Product Data, and Samples

No set of construction drawings is ever truly complete. The purpose of drawings is to convey intended results, and contractors can achieve these results by choosing from among various specified or approved products.

Since several products may satisfy the intent of the specifications, but may vary in size or require different installation methods and details, contractors prepare shop drawings to graphically indicate the fabrication and installation of a particular product.

Product data and samples are similar in purpose to shop drawings. Product data provide specific information about a product's performance in the form of charts, brochures, diagrams, or instructions. Samples are representative of a material's color, texture, finish, workmanship, etc., and establish physical standards for future work. Architects review all such submittals—shop drawings, product data, and samples—but only to determine whether or not they comply with the design intent.

Construction Specifications

Project Manual

A Project Manual contains technical information, as well as other documents related to legal and procedural requirements. These include bidding documents, applicable contract forms, documents that relate to equal employment opportunity and labor wage requirements, and so on.

Technical specifications (Divisions 1 through 16) are prepared by the architect and consultants as part of their basic services, while most other documents are prepared by the owner and the owner's representatives, including attorneys, insurances agents, and consultants. The architect, or construction manager if any, assembles these documents into a Project

Manual. For contents of a typical Project Manual, see Table 9.2.

Use of Standard Forms

AIA documents and forms are often included in Project Manuals. They may include standard forms for the Owner-Contractor Agreement, the

General Conditions, Instructions to Bidders, various bond forms, as well as administrative forms relating to payments to the contractor, field administration, and completion of construction. One of the main advantages of using standard AIA forms is that most people in the construction industry are familiar with their contents and how they have previously been interpreted. Since contractors understand their intent, they do not have to provide for contingencies in their bid to allow for potentially unclear documents. Thus, project administration is simplified.

The CSI MasterFormat, developed and published by the Construction Specifications Institute, is widely used in the United States to organize specifications. It is well known in the construction industry and helps architects avoid potential gaps and overlaps in specifications.

The CSI MasterFormat is divided into *Divisions, Sections*, and *Parts*. MasterFormat originally had 16 divisions to comprise the permanent framework of the specifications. This system underwent extensive revision, and an expanded MasterFormat was published consisting of 50 divisions. Divisions were added to address the increasing complexity of building systems, existing Divisions were modified, and the section numbering was converted to a six-digit system. Refer to Table 9.3 and Table 9.4. Each Division has a fixed name and number, as shown in the right column. A *Section* describes the basic unit of work, such as a specific product or piece of equipment, and its installation. For example, Division 9, Finishes, might include a Section on Plaster and Gypsum Board, as shown in the right column.

Each Section is further divided into three *Parts*: General, Materials, and Execution. The *General Part* deals with the coverage or scope of a Section. It describes related work, definitions, quality control, submittals, and guarantees/warranties. The *Materials Part* lists and describes the materials, products, and equipment to be used. In shortened or outline specifications, this Part predominates. The *Execution Part* details the manner in which products and materials will be installed and work performed. In addition, coordination with other trades, inspection and acceptance of their work, tests, and other similar items may also be covered. Since contractors usually are permitted to choose among various acceptable products or equipment, it is best not to describe the attributes of particular items too specifically. Affording contractors the opportunity to submit data on products and preferred methods is more practical and, possibly, more economical.

The AIA General Conditions explicitly states that the organization of the specifications into divisions, sections, and articles, and the arrangement of drawings shall *not* control the contractor in dividing the work among subcontractors or in establishing the extent of work to be performed by any trade. General contractors are generally more familiar with labor markets and union labor jurisdiction agreements than architects. Each contractor is also free to utilize a unique procedure for accomplishing the required work and must be responsible for covering potential gaps in the assignments of subcontractors.

TYPICAL MASTERFORMAT SECTION HEADINGS

09 02 00	Plaster and Gypsum Board
09 30 00	Tiling
09 50 00	Ceilings
09 60 00	Flooring
09 70 00	Wall Finishes

Table 9.3

MASTER FORMAT—NUMBERS AND TITLES

DIVISION NUMBERS AND TITLES

Procurement and Contracting Requirements Group
Division 00 Procurement and Contracting Requirements

General Requirements Subgroup
Division 01 General Requirements

Facility Construction Subgroup
Division 02 Existing Conditions
Division 03 Concrete
Division 04 Masonry
Division 05 Metals
Division 06 Wood, Plastic, and Composites
Division 07 Thermal and Moisture Protection
Division 08 Openings
Division 09 Finishes
Division 10 Specialities
Division 11 Equipment
Division 12 Furnishings
Division 13 Special Construction
Division 14 Conveying Equipment
Division 15 Reserved
Division 16 Reserved
Division 17 Reserved
Division 18 Reserved
Division 19 Reserved

Facility Services Subgroup
Division 20 Reserved
Division 21 Fire Suppression
Division 22 Plumbing
Division 23 Heating, Ventilating, and Air Conditioning
Division 24 Reserved
Division 25 Integrated Automation
Division 26 Electrical
Division 27 Communications
Division 28 Electronic Safety and Security
Division 29 Reserved

Site and Infrastructure Subgroup
Division 30 Reserved
Division 31 Earthwork
Division 32 Exterior Improvements
Division 33 Utilities
Division 34 Transportation
Division 35 Waterway and Marine Construction
Division 36 Reserved
Division 37 Reserved
Division 38 Reserved
Division 39 Reserved

Process Equipment Subgroup
Division 40 Process Interconnections
Division 41 Material Processing and Handling Equipment
Division 42 Process Heating, Cooling, and Drying Equipment
Division 43 Process Gas and Liquid Handling, Purification, and Storage Equipment
Division 44 Pollution and Waste Control Equipment
Division 45 Industry-Specific Manufacturing Equipment
Division 46 Water and Wastewater Equipment
Division 47 Reserved
Division 48 Electrical Power Generation
Division 49 Reserved

Table 9.4

Master specifications have been developed using word processing programs that provide automated methods of editing specifications to suit a particular project. Some masters are developed by architectural firms, and some are commercial or proprietary systems. In either case, masters are intended to reduce a specifier's clerical and repetitive work. They allow architects to spend more time on research and make written technical information available to project teams in the early stages of the design process.

Before master specifications were developed, specifiers usually edited sections from previous projects or created new sections based on data from manufacturers and trade associations. The first master specifications were *text-based*, comprising comprehensive data bases of practically all available products and methods. A second type is *knowledge-based* specifications, which use a dialog (question-and-answer) method to access the data bases. Text-based systems are

reductive, while knowledge-based systems are additive.

However, there are some problems associated with the use of master systems. Since it is easier to edit by deleting unnecessary or inapplicable material than to write new material, a master specification should be applicable to every project. Unfortunately, it is difficult to create a master that is totally comprehensive.

It is also difficult to maintain an accurate and up-to-date master system with rapidly changing technology. For these reasons, many architects subscribe to one of the commercially available proprietary systems. Whichever system is used, it is important to guard against accepting materials and processes merely because they are listed in the master, instead of thorough, independent analysis.

Organization

The relationship between the AIA General Conditions and Division One-General Requirements of the MasterFormat Specifications must be understood. The General Conditions contains contractual provisions that elaborate on elements of the AIA Owner-Contractor Agreement. They are intended to apply to many projects and situations. By contrast, the material in Division One of the specifications describes the administrative rules and work-related provisions for the specific project. A well-written Division One can help a project run smoothly during the construction phase. An example of the typical sections in Division One is shown in Table 9.5.

Types of Technical Specifications

There are several types of technical specifications, and examples of each may be found in any Project Manual. There is nothing inherently wrong with mixing types if they are used correctly.

Proprietary specifications call for desired materials, products, systems, and equipment by their trade names and model numbers. Proprietary specifications are relatively easy to prepare since they rely on commercially available products, which are described in detail in their manufacturers' literature, not in the specifications. Architects should thoroughly investigate a manufacturer's claims for such products and systems. The track record of the manufacturer and the product, as well as its suitability for a particular application, should be carefully investigated.

There are two kinds of proprietary specifications: *closed* (sole source) and *open* (equal). See Table 9.6. Closed specifications require a particular brand or trade name and do not permit substitution. They are intended for situations where only one product will provide the desired result. For example, in a renovation project where only a few windows need to be replaced, a specific brand and model of window may be required. Closed specifications are not usually permitted on publicly-funded projects, where open, competitive bidding is required.

Open specifications name several (usually three) acceptable materials, products, or systems, and contractors may use any one of them. Alternatively, other approved products that match the capabilities and quality of the named items may be used if the open proprietary specification contains an *approved equal* clause. Open specifications are most often used on publicly-funded projects because they promote competition while avoiding questions of impropriety or favoritism in the selection of materials, products, and systems. Open specifications are also used on private projects because they allow contractors to apply their expertise to the construction process while decreasing costs through open competition.

DIVISION ONE, GENERAL REQUIREMENTS

CSI Sections MasterFormat	Description
01 11 00	Summary of Work
01 20 00	Price and Payment
01 21 00	Allowances
01 22 00	Unit Prices
01 23 00	Alternates
01 32 00	Construction Progress Documentation
01 33 00	Submittal Procedures
01 45 00	Quality Control
01 50 00	Temporary Facilities and Controls
01 60 00	Product Requirements
01 25 00	(Substitution Procedures)
01 70 00	Execution and Closeout Requirements
01 78 39	Project Record Documents

Table 9.5

TYPICAL EXAMPLE OF PROPRIETARY OPEN SPECIFICATION

A. Admixtures
   1. Water-reducing and air-entraining agents shall be used in all concrete, in strict accordance with the manufacturer's printed instructions. Total air entrained in freshly mixed concrete shall be 5.0% plus or minus 1.0% of volume of concrete with required strengths maintained.
   2. Water-Reducing Agent: "Sonotard WR" by Sonneborn Building Products, "WRDA" by W. R. Grace Company, "Pozzolith 100" by Master Builders Company, or Sika "Plastocrete N." Water-reducing agent shall be by same manufacturer as air-entraining agent.
   3. Air-Entraining Agent: "Darex" by W. R. Grace Company, "Aerolith" by Sonneborn Building Products, "MBVR" by Master Builders Company, or Sika "AER."

Table 9.6

Frequently, the architect may have to determine whether a material or product proposed to be substituted by the contractor is equal in quality and performance to that specified. Division One, General Requirements, must be specific in describing the administrative procedures for contractors to follow in order to obtain approval for such substitutions. The contractor should be responsible for submitting complete technical data to the architect for evaluation. Without the architect's review and approval, a substitution cannot be considered to be an approved equal. In evaluating proposed substitutions, architects must determine whether the aesthetic intent will be met. Furthermore, they must consider value, quality, warranties, the manufacturer's reputation, compliance with code requirements and regulations, operating and maintenance costs, size and weight, ease of construction, construction labor and equipment requirements, and operational characteristics.

Substitute products or systems do not have to be identical to those specified, since not all the features of a specified product may be required. If a product can meet desired results and has the most important features, substitutions may be acceptable.

Performance specifications define products or systems by describing desired end results that are performance oriented. In such specifications, the precise composition of individual components or systems is not described. This method allows contractors and manufacturers to apply their unique expertise and encourages broad competition and maximum creative input. Performance specifications are most appropriate when new or unusual products or systems are required or when innovation is necessary.

It can be challenging to prepare performance specifications. Describing the problems or the conditions in which products or systems must operate, and the parameters for acceptable solutions, is difficult. Performance specifications must explicitly define required testing methods and procedures for evaluating performance. Energy consumption costs, aesthetics, and similar factors may be especially difficult to specify.

TYPICAL EXAMPLE OF PERFORMANCE SPECIFICATION

A. Sprayed-On Fireproofing

Materials, procedures for application, dry densities, and thicknesses necessary to provide the required protection shall have been tested in accordance with ASTM E-119 and approved by UL for the uses indicated.

B. Structural Steel Members and Roof Deck

All structural steel members and roof deck shall be protected under this Section with adequate fireproofing thicknesses and densities to provide the following fire resistance ratings.

Steel columns and beams supporting more than one (1) floor ..... 3 hours
Steel columns supporting roof deck ..... 2 hours
Metal roof deck and supporting steel members ..... 1 hour
Steel members supporting one (1) floor ..... 2 hours

Load: In addition, beams shall have sustained the applied load during the ASTM E-119 fire endurance test; and the transmission of heat through the beam protection during the period of fire exposure for the specified rating shall not have raised the average (arithmetical) temperature of the steel at any one of four sections above 1,200°F (648.8°C) and shall not have raised the temperature above 1,400°F (760.0°C) at any one of the measured points.

Thickness and Density: Where the thickness of fire protection material for the specified fire resistance rating is given as an average thickness, the minimum thickness shall be that given as average thickness. Acceptable minimum thickness of applied material shall be that measured at specified dry density. Minimum applied dry density per cubic foot shall be 18 pounds.

Fire ratings interpolated or extrapolated from actual test data will not be accepted. Provide evidence prior to application that proposed materials and installation methods and materials have been approved by all authorities having jurisdiction.

Table 9.7

TYPICAL EXAMPLE OF REFERENCE SPECIFICATION

A. Steel Stud Shear Connectors shall conform to the requirements of Articles 4.26 and 4.27 of "Structural Welding Code" AWS D1.1-77 of the American Welding Society.

B. Bolts, Nuts, and Washers shall comply with ASTM A325. Bolt dimensions shall comply with requirements of ANSI Standard B18.2 for structural bolts, except that the radii of the filler under the bolt head shall not be less than 1/32" for bolts up to 1" in diameter. Nut dimensions shall comply with requirements of ANSI B18.2 for heavy semi-finished hexagonal nuts. Circular washers shall be flat and smooth and bevel washers square or rectangular. All washers shall comply with requirements of ANSI B27.2 for Type A washers. Where clipping of washers is necessary, clip one side only and not closer than 7/8 of the bolt diameter from the center of the washer.

Table 9.8

TYPICAL EXAMPLE OF DESCRIPTIVE SPECIFICATION

Solid Wood Door Construction

A. Except as otherwise indicated, all flush wood doors (except UL doors specified hereinafter) shall be wood solid core doors 3'-0" x 7'-0", 1-3/4" thick of 5-ply construction with face veneers bonded to both faces. Cores shall be solid stave low density wood blocks bonded together under heat and pressure. Cross bands shall be thoroughly kiln-dried hardwood, 1/10" thick, extending full width of door. Core construction shall be AWI Type "SLC," non-resinous wood.

B. Face veneers shall be standard thickness (1/28") paint grade veneer. Vertical stile edges and top and bottom rail edges shall be hardwood. Vertical edges shall be 5/8" minimum, top and bottom 2 rails shall be 1-1/4" minimum. Face veneers shall be AWI Type "1." Doors shall be completely sanded, ready to receive paint finish in the field under PAINTING Section.

C. Solid core doors shall meet or exceed the requirements of U.S. Department of Commerce Commercial Standard CS-171, and shall be equal to DSC-1 manufactured by Weyerhaeuser Company, or equal as approved by the Architect from manufacturer specified hereinbefore. Except as otherwise indicated, doors shall be AWI "Custom" Grade.

Table 9.9

Reference specifications refer to quality standards established by recognized testing authorities or by the federal government. They are typically used in conjunction with other types of specifications. It should be understood, however, that the quality and performance described in the referenced specifications may only be a minimum level and not appropriate or sufficient for the specific application. An architect's specifications must clearly state which parts of the referenced specifications are meant to apply. Standard reference specifications are also dated, and the latest version should be researched before it is cited.

Descriptive specifications are the most detailed of all specifications. They describe all components of products, their arrangement and methods of assembly, physical and chemical properties, arrangement and relationship of parts, and numerous other details and requirements. In descriptive specifications, the architect assumes total responsibility for the function and performance of a product. Unless the architect is certain the assembled product will function properly, the use of this type of specification should be avoided. See Table 9.9.

Cash allowance specifications are used in lieu of specifying a particular portion of the work.

Under this method, an architect directs bidders to set aside a specified amount of money to be applied to the construction work at the architect's direction. Cash allowance specifications are used when full information on levels of quality has not been determined or is not available at the time bids are solicited. Hardware and carpeting are often handled in this manner. Types and quantities of hardware may be determined on the basis of the drawings, while levels of quality may have to be determined later. Similarly, the extent of carpeting may be known, but not the type or quality. These determinations are sometimes delayed in order to meet a project's budget limitations.

Cash allowances may be used for the purchase and delivery of the product only, in which case the installation is indicated in the construction documents and included in the base bid. Alternatively, a cash allowance may be used for both furnishing and installing the product.

In some cases, products are indicated as *owner furnished-contractor installed* on the construction documents. Although not a cash allowance, an owner-furnished product may be installed as part of the contractor's scope of work. A product indicated as *NIC (not-in-contract)* is neither furnished nor installed by the contractor.

If cash allowances are used, specifications should include information on installation methods, the dollar amount of the allowance, and methods of measuring costs to be applied against allowance amounts. When installations are complete, costs can be compared with allowance amounts and the difference credited to the owner or contractor as appropriate. The example in Table 9.10 is taken from Division One, General Requirements. The installation requirements are located in Divisions 8 and 9 as noted.

TYPICAL EXAMPLE OF CASH ALLOWANCE SPECIFICATION

A "Schedule of Allowances," showing amounts included in Contract Sum, is included at the end of this Section. Coordinate allowance Work with related Work, to ensure that each selection is completely integrated and interfaced with related Work. Requirements for the Work of allowances are shown and specified, to extent established by date of Contract Documents; additional requirements are established by Change Order. At earliest possible date, advise Architect of date each final allowance selection must be completed. Submit proposals for allowance Work as directed, and in the manner specified for Change Orders. Indicate quantities, unit costs, total purchase amounts, taxes, delivery charges and trade discounts. Where requested, furnish detailed breakdown of quantity survey. Contractor mark-up on overrun of allowance purchases will be permitted where purchase amount exceeds established allowance by more than 15%; otherwise, and except as otherwise indicated, amount of Change Order on each allowance will be difference between purchase amount and allowance. Deliver excess materials of allowance Work to Owner's storage space, or dispose of by other means as directed.

Schedule of Allowances

Allowance No. 1 A lump sum of $3,000 for purchase of finish hardware, as defined by and specified in Specification sections of Division 8.

Allowance No. 2 A lump sum of $5,000 for purchase of carpet, as defined by and specified in Specification sections of Division 9.

Table 9.10

Effect of Multiple Prime Contracts

When multiple prime contracts are used, rather than one general contract, specification sections may have to be written for individual construction trades. This situation, which often occurs on public projects, requires increased effort on the part of the architect. First, architects must understand local trade union work rules and jurisdictional requirements. Second, many parts of the specifications must be duplicated, increasing the coordination required of architects. For example, each section must include its own agreement, general conditions, and general requirements documents. If there are gaps in assignment of construction work, the architect may be held responsible for such omissions.

Interpretation

Where construction documents are inconsistent or ambiguous, or have gaps or overlaps in coverage, they may be open to interpretation.

When two clauses in the specifications conflict, the more specific clause will usually prevail over the more general clause. Handwritten provisions will usually prevail over typewritten provisions, which in turn take precedence over pre-printed provisions. These cases illustrate the principle that individual and personal attention to an item more likely reflects the author's intent.

When two drawings conflict or are inconsistent, the more recent drawing will usually prevail. Dates of all revisions should appear on drawings, and the items involved in each revision should be clearly indicated. When different drawings are prepared at the same time, large scale detailed drawings will usually prevail over small scale general drawings, such as floor plans and elevations. This type of hierarchy can be made part of the construction contract by incorporation in the Supplementary Conditions. Specifications sometimes indicate one requirement and drawings another. Subparagraph 1.2.1 of the AIA General Conditions, Document A201, states: "The Contract Documents are complementary, and what is required by one shall be as binding as if required by all..." Inconsistencies are not resolved by an arbitrary order of precedence, but must be brought to the architect's attention for appropriate resolution. The AIA General Conditions is clear in regard to the interpretation of the contract documents. Subparagraph 4.2.11 states: "The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents..."

DOCUMENT COORDINATION

Compliance with Code Requirements and Regulations

A coordinated and detailed response to code requirements from the entire design team is essential to the success of a project.

Consider, for example, energy requirements. Siting, preliminary selection of materials, and schematic organization of programmatic elements are largely within an architect's control. These energy considerations must be balanced against other requirements more closely controlled by others, including structural requirements.

Fire protection also requires building team coordination. The incorporation of interior courtyards or atriums, for example, may require engineering for fire protection. Mechanical, electrical, and plumbing equipment are often critical elements in a fire protection plan. When there are no physical barriers to the spread of potential fires, protection depends upon sensing devices, sprinkler systems, and air handling equipment. These systems and building

components are likely to be designed or selected by the engineering and fire protection consultants, rather than the architect.

The mechanical, plumbing, and electrical codes often have provisions that are the same as or that complement the building and life safety codes. These common provisions are generally understood by most design professionals. Architects, however, cannot always be certain that engineers and other consultants have complied with all code provisions. As a practical matter, architects of complex projects may simply inform consultants about which codes are applicable, and ask them to research the detailed requirements. This does not relieve architects, however, of responsibility to meet code requirements. As leader of the design team and the party contracting with the owner for professional design services, the architect has prime responsibility for code compliance. However, each engineering consultant must sign the drawings submitted for plan review by the code official and thereby also becomes responsible for compliance. Moreover, the AIA Architect-Consultant Agreement (Document C401) states that the consultant is responsible for code compliance in the same manner and extent that the architect is responsible to the owner.

Initially, architects should verify that each member of the project team is working from the same set of code requirements. Consultants should inform the architect about significant aspects of their work that are required by code. Although codes generally allow several responses to requirements, they occasionally require specific design features. Consequently, architects must know which design elements may change and which may not.

Architects are responsible to notify their consultants of design decisions that have code implications. For example, fire walls must be clearly identified, so that air handling ducts passing through them include fire and smoke dampers. See Figure 9.3. Alternatively, the duct work could be arranged to avoid fire walls altogether. Ceiling appearance is affected by the type and location of sprinkler heads. If ceilings are required to be fire rated, light fixtures and air handling grilles must be properly accommodated.

Compliance with Design Criteria

Aesthetics

Consultants can significantly influence the aesthetic character of a project. Structural expression, for instance, is an important element in many architectural designs. Structural engineers often collaborate with architectural designers to achieve such aesthetic goals. The structural design of the cross-braced frame of the John Hancock Building and the bundled tube design of the Willis Tower, both in Chicago, are good examples of positive aesthetic qualities achieved through the mutual efforts of architects and their structural engineers. On a smaller scale, the structural design of framing members influences floor-to-floor height, and thus overall building height, by establishing the floor structure's depth. The relationship of spandrels to window openings is often critical to the proportions of a building's facade. In many instances, the basic character of a building is a result of its structural expression, as in a domed structure or an air-supported roof.

Mechanical engineers may influence wall treatments by their response to energy considerations. Their work can affect the character of the building's envelope, including its fenestration in relation to solar orientation. On a smaller scale, the location and design of air diffusers can affect the aesthetic appearance of interior spaces. Where mechanical equipment is exposed to view, architects normally ask to review and approve illustrations showing the equipment's physical appearance. Unsightly fans on rooftops can seriously detract from an architect's design.

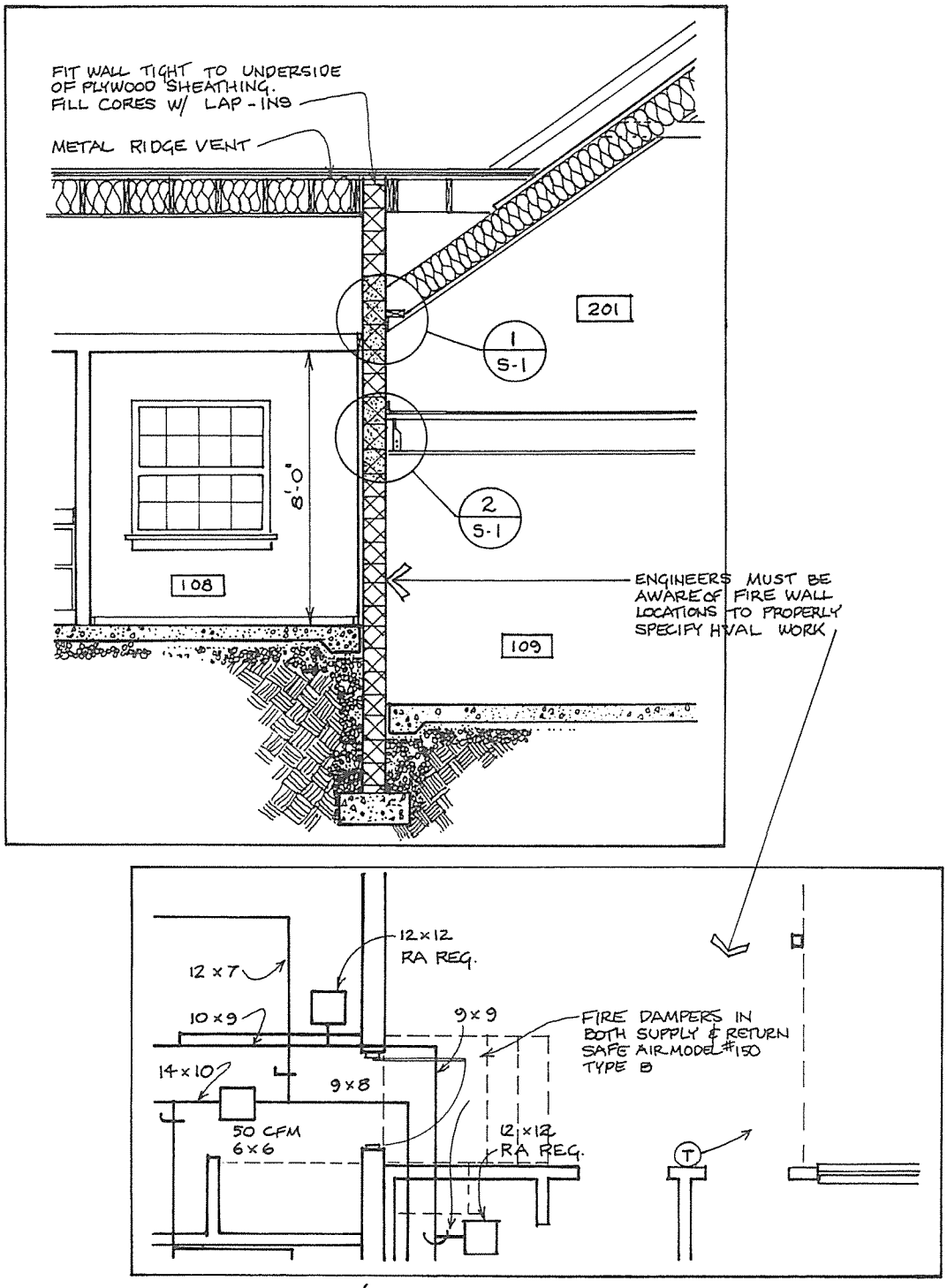

FIT WALL TIGHT TO UNDERSIDE OF PLYWOOD SHEATHING. FILL CORES W/ LAP-INS
METAL RIDGE VENT
201
1
S-1
2
S-1
8'-0"
108
109
ENGINEERS MUST BE AWARE OF FIRE WALL LOCATIONS TO PROPERLY SPECIFY HVAL WORK
12x12 RA REG.
12 x 7
10 x 9
9 x 9
FIRE DAMPERS IN BOTH SUPPLY & RETURN SAFE AIR MODEL #150 TYPE B
14 x 10
9 x 8
50 CFM
6 x 6
12 x 12 RA REG.
T
ARCHITECTURAL/ENGINEERING COORDINATION

Figure 9.3

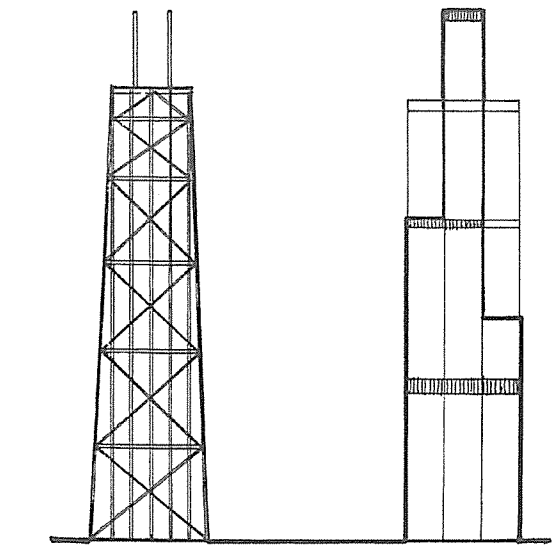


Figure 9.4

Electrical engineers, through selection and placement of light fixtures, can affect the aesthetic quality of spaces and ceilings. With the development of open plan office design and the use of task lighting, electrical engineers may also influence the design and placement of partitions, furniture, and equipment. Offices commonly contain video display equipment, computers, communications equipment, and electronic sensing devices for security and fire protection. These items of equipment are generally selected by the electrical engineer, in consultation with the architect.

Food service consultants, lighting consultants, acoustical consultants, and art advisors may also influence a building's aesthetic qualities. Architects must always inform their consultants of design criteria and the aesthetic effects they are trying to achieve. Product data, study models, and photographs may be used to assess intermediate design progress, and are subject to the architect's final approval. Architects must know enough about the details of their consultants' work to maintain design control. At times, they may suggest alternate approaches or solutions more compatible with the desired aesthetic character of the project.

Quality Control

Since many of the construction documents prepared by consultants are based on calculations, quality control is relatively easy to achieve. Parameters are well defined and solutions can easily be checked.

Details that are shown on the drawings must be in conformance with engineering design assumptions. If a structural engineer designs a moment-resisting frame, for example, the joint details must reflect that condition. Architects may review consultants' construction documents to confirm that designs, details, and specifications are compatible with the consultants' calculations and assumptions.

An architect can support a consultant's quality control by informing her of all relevant design criteria to which the consultant must adhere, and by requiring the consultant to schedule periodic reviews by experienced senior staff members or *peer review* by others in the consultant's profession.

Although architects can check for internal consistency and for apparent compliance with standards, consultants are primarily responsible for quality control of their own work.

Cost Control

Estimating *initial costs* is an essential part of a consultant's work. The percentage of the total budget allocated to each discipline varies with building type and project scope. Architects often establish budgets for the major elements of construction work for incorporation into

an overall project budget. Once the budget is established, consultants are expected to design within its limits. Consultants must, therefore, be accurate in predicting initial costs so that the architect can prepare a reliable overall project estimate.

Because operating costs tend to vary inversely with initial costs, a relatively low construction budget may imply that life cycle costs will be relatively high. Consultants must evaluate conflicting considerations in order to produce optimum design solutions. Likewise, architects must review each alternative to be sure that a consultant's decision serves not only the architect's particular discipline, but the project as a whole.

Operational costs may be difficult to calculate. Calculations involve more than the characteristics of specified equipment; they can involve the operating characteristics of the owner's organization and other factors affecting a facility, such as changing climatic conditions. Engineering calculations may, in some instances, be based on assumptions different from actual conditions. For example, a facility may be operated differently than anticipated by its program; calculations may be based on average conditions, in spite of the fact that extreme weather conditions may have been experienced in recent years; or fuel prices may have increased suddenly and unexpectedly.

It is important that basic design assumptions are realistic. Architects should understand the operating characteristics of facilities, and they must ensure that design assumptions are accurate and that designed elements and systems will be appropriate.

Maintenance is an important aspect in the selection of products and systems. Some mechanical and electrical systems are complicated, sophisticated, and sensitive. If properly balanced, they can be efficient and economical. But, they can also be troublesome and more difficult to maintain than simpler, less technically advanced systems. Equipment maintenance costs vary with the size and skill of maintenance staffs. Some design professionals have expanded their practices to include facilities management services, including the preparation of detailed operational and maintenance programs.

Specified systems must be properly installed, reliable, and receive scheduled maintenance to be successful. The architect should determine that such systems are appropriate to the contractor's and building manager's degree of sophistication.

Compatibility with Other Elements

The *size and weight* of equipment is another design consideration. Engineering drawings are largely diagrammatic, making it difficult to verify that design criteria have been met. For example, a large pipe or duct may be represented by a single line on a drawing, but its actual size determines the clearances which must be provided and maintained. Unfortunately, these considerations are sometimes ignored. Architects can create similar problems by providing insufficient space for equipment and services during design development phases. Allotted spaces might prove to be too small, and increasing the building's gross area may be difficult without disrupting the overall architectural solution and budget.

Operational characteristics of mechanical and electrical equipment must be considered by the design team before final selections and placement are made. In critical cases, a special consultant, such as an acoustical engineer, may be retained to advise the design team on the placement, isolation, and construction of large air handling equipment. Electrical distribution equipment can interfere with the operation of

sensitive laboratory or hospital equipment. In this case, the architect may ask the owner to provide the services of a special consultant to advise the design team on the placement, selection, and isolation of certain equipment.

Ease of Construction

Labor and Equipment Requirements

Architects and their consultants should determine that the systems they design can actually be built, considering the space, equipment, and labor required. For example, if a floor system utilizes precast concrete T-beams, there must be sufficient room on the site to position the cranes required to erect these units. If construction access is available from one side of a site only, construction must be able to proceed in only one direction. Post-tensioned structures require accurate placement of tension cables and hydraulic jacks to stress tendons properly. The availability of the skilled and experienced labor necessary for these operations influences the decision to utilize such systems.

Large air-conditioning chillers and cooling towers are often placed on the upper stories or roofs of multistory buildings. If they cannot be disassembled and installed in sections, they must be lifted intact to their final locations. Once in place, equipment and systems may require sophisticated pneumatic and electrical controls and precise balance in order to operate properly. The installation of sensitive equipment requires the availability of skilled technicians.

In making design decisions, the architect's consultants must consider the limitations of local labor and the availability of special equipment. They must be aware of the implications of applicable union rules. Although contractors must determine the appropriate trade for each part of the work, both architects and consultants should follow established and generally accepted operating procedures, and understand their impact on design decisions.

Sequencing

Engineers and other consultants must see their drawings in terms of the construction sequence as well as the final product. Very large components of mechanical equipment must be brought up to, and placed into, equipment penthouses after they are manufactured. Buildings must remain structurally stable during construction. Once installed, equipment must be accessible for servicing or to remove and replace malfunctioning units.

Architects should review consultants' construction documents with the construction process in mind. The sequence of construction and workability of the scheme throughout the construction process must be considered. Major building elements must fit into place at the appropriate time and without disrupting other ongoing activities.

Scheduling

It may be desirable to order certain components of a building well in advance of their installation. Major HVAC components, large electrical transformers or switchgear, and curtain wall systems are frequently custom made for a particular project. These elements are not generally in a warehouse waiting to be purchased. Even standard catalog items are often manufactured only when specifically ordered and require a significant amount of lead time before delivery.

Architects' consultants must be involved in scheduling to enable major items to be available when needed. Contractors are often selected too late to order long-lead time equipment in a timely manner. One solution is for the owner, on the advice of the architect and consultants, to order equipment directly. When a contractor is subsequently selected, purchase

orders are assigned from owner to contractor. Upon delivery, the items are received and installed in the same way as if the contractor had been involved from the beginning.

Fast-track delivery procedures work generally the same way. A project is divided into packages or stages of work, each of which represents a separate prime contract. Starting construction and ordering items before all the construction drawings are completed helps to ensure the availability of products when needed, and tends to control costs during periods of rapid inflation.

Architects must be sure that consultants specify and package items according to proper criteria. Information about a project's ultimate character and configuration may be limited when ordering. Circumstances may change between the time orders are placed, or a construction package let, and the time an item is received or final drawings completed. An architect must work with consultants to determine important features, while leaving other aspects open to inevitable change. This may result in excess capacity in equipment or the need to alter designs to integrate with equipment or items already ordered.

Consultants must also be aware of overall construction schedules and, within these schedules, pertinent installation periods. If a new chiller or cooling tower is required before summer, or a new boiler or heating plant before winter, engineering designs must allow equipment to be built and installed in time. Or, if construction must occur during winter months, structural engineers may want to avoid the use of reinforced masonry, which requires special measures to protect mortar from freezing.

These concerns are especially applicable to renovation projects. An old system may have to be changed to a new one, or an owner may require that a new wing or suite be ready before the old one is abandoned. Some considerations will be apparent from construction documents, while others will not. Architects must be certain that timing has been considered and is realistic.

An owner may rely upon the architect and the architect's consultants for pre-construction services such as cost estimating, scheduling and sequencing, and reviewing ease of construction.

Construction Management

With the advent of fast-track and other sophisticated methods of procurement, some owners have retained *construction managers (CMs)* to provide these pre-construction services.

Construction management may be defined as *activities over and above normal architectural and engineering services, conducted during the pre-design, design, and construction phases, which contribute to the control of time and cost.*

Despite this simple definition, the scope of the CM's functions vary widely from project to project. The CM often joins the project team during the design phases and either remains as an adviser or becomes the constructor as well.

If the CM is an adviser, it acts as the owner's agent and provides the owner with impartial technical advice. The appropriate AIA form is the Owner-Construction Manager Agreement (Document C132).

Internal Coordination of Consultants' Documents

The architect is the prime professional under contract to the owner, and as such, liable for the consultants' work. Prudent architects, therefore, try to make certain that their consultants provide appropriate levels of professional service. There are some practical limits, however.

One limit is that architects cannot check each consultant's documents for internal consistency and coordination. That is the responsibility of each consultant. If an electrical engineer specifies one type of lighting fixture, the drawings should not show another. Dimensions should be accurate, and drawings and specifications should be coordinated. The AIA Architect-Consultant Agreement (Document C401) specifically requires the consultant to be responsible for coordinating her own work.

When a consulting firm combines more than one engineering discipline, coordination becomes more complicated. For example, structural, HVAC, plumbing, and electrical work may all be done in different departments of the same consulting firm. Generally, a consultant's documents must be made internally consistent by that consultant. Structural and mechanical documents must be checked against each other for conflicts prior to being sent to the architect. Someone in the consulting firm must be responsible for this interdisciplinary checking.

Overall Coordination of Consultants' Documents

Format for Specifications

Specifications prepared by an architect and the consultants are bound together into a Project Manual. All the work of the individual parties must be coordinated to produce a unified document, not a collection of individual parts. To accomplish this, architects establish formats for consultants to follow.

Coordination extends from simple considerations, such as the color of the paper on which the specifications of different consultants is printed, to the format and numbering system used. The consultants' input to bid forms, including instructions to bidders, and to Division One, the general requirements of the specifications, must be established. Overall, each consultant's work must be coordinated with that of the architect and the other consultants.

The architect must require that the consultants participate in the preparation of the requirements of Division One, so that their individual specification sections are appropriately coordinated. The architect is the one professional on a project team with the required perspective to coordinate the many diverse elements of a Project Manual.

Diagrammatic Mechanical and Electrical Drawings

Most construction documents prepared by mechanical and electrical consultants are diagrams or schedules. HVAC drawings show dimensions of ducts. Major pieces of equipment are shown, but other physical conditions are not represented. Duct dimensions may not include the thickness of required insulation. Electrical documents are more diagrammatic. Typically, wiring is indicated in floors or in ceilings, as are home runs to panelboards. Actual conduit locations, however, are usually determined by contractors in the field. Plumbing drawings are less diagrammatic than HVAC and electrical drawings, but pipes and fittings are not drawn to scale. The exact location of piping may be determined by the contractor in the field.

While these different methods of representation are logical, checking and coordination is difficult. Architects can overlay drawings of the various consultants to spot potential conflicts. Even where lines do not cross in such overlays, this does not guarantee adequate clearances, since the diagrams may not be precise enough. Overlay drafting and CAD make it easier for architects to identify and resolve conflicts before they become construction problems.

Serious construction problems may be caused by uncoordinated drawings. Contractors may have problems installing mechanical ducts and electrical conduits within the space actually provided. For example, walls may be framed without adequate space for plumbing lines. Architects must address such potential problems when checking the consultants' documents.

SECTION 07 11 13—BITUMINOUS DAMPPROOFING

Part 1—General

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Substrate preparation.
2. Bituminous dampproofing.

B. Related Sections:

1. Unit Masonry: Section 04 20 00.
2. Thermal insulation: Section 07 21 00.
3. Flashing AND Sheet Metal: Section 07 60 00.

1.03 SUBMITTALS

A. Product Data: Submit technical product information and installation instructions which demonstrate that products comply with project requirements.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver dampproofing materials to project site in factory-sealed containers.

B. Store materials in dry, well-ventilated space.

1.05 SITE CONDITIONS

A. Install dampproofing only when site weather conditions are acceptable per manufacturer's recommendations.

B. Ventilation: Provide sufficient ventilation during application and curing of dampproofing to prevent buildup of toxic or flammable fumes.

Part 2—Products

2.01 DAMPPROOFING MATERIALS

A. Fibrated Dampproofing: Cold-applied, asphalt emulsion semi-mastic of spraying or brushing (medium) consistency, meeting the requirements of ASTM D 1227, Type IV; asbestos free.

1. Products: Provide one of the following:
   a. "A-H Semi-Mastic Emulsion, Asbestos Free"; Anti Hydro Company, Inc.
   b. "No. 220 AF Fibrated Emulsion Dampproofing"; Karnak Corporation.
   c. "Hydrocide 700B Semi-Mastic"; Sonneborn Building Products Division/ChemRex, Inc.
   d. "Sealmastic, Type 2"; W.R. Meadows, Inc.

2.02 INSTALLATION ACCESSORIES

A. Detailing Mastic: Asphalt-based plastic roof cement, trowel consistency, meeting the requirements of ASTM D 4586; asbestos free.

Part 3—Execution

3.01 EXAMINATION

A. Verify that surfaces are smooth, sound, clean, and dry, and that elements which will penetrate dampproofing have been completed and are rigidly installed.

3.02 PREPARATION

A. Remove ridges and projecting rough areas.

B. Fill cracks, holes, and irregularities with detailing mastic as recommended by membrane manufacturer.

3.03 INSTALLATION

A. General: Comply with dampproofing manufacturer's instructions for handling, preparation, application, and protection of dampproofing materials.

B. Dampproofing: Apply dampproofing to entire exterior face of concrete masonry back-up wythe (inner wythe) for all cavity wall construction and other locations indicated.

1. Apply 2 coats of bituminous dampproofing at manufacturer's recommended coverage rate.
2. Apply coatings using application method best suited for obtaining full, uniform coverage of surfaces to be coated.

C. Coordinate dampproofing work with installation of the following materials:

1. Brick masonry.
2. Masonry flashings: Ensure watertight flashing installation.
3. Cavity wall insulation.

3.04 PROTECTION AND CLEANING

A. Take measures required to protect completed dampproofing after installation.

B. Clean spillage and soiling from adjacent surfaces using cleaning agents and procedures recommended by the manufacturer of the surface.

END OF SECTION 07 11 13

EXAMPLE OF SPECIAL CONDITIONS

SPECIAL CONDITIONS

1. Soil Borings

A. Subsurface soil investigations have been made at the site, and logs of the test holes are available in Architect's office to assist in ascertaining character of material to be encountered. Contractor shall make his own interpretation of the data, since Owner or Architect or Soils Engineer in no way guarantees adequacy or accuracy of the data or that data are representative of all conditions to be encountered.

2. Maintenance of Traffic

A. The Contractor shall maintain traffic on all streets adjacent to or leading to the site. Where construction operations interfere with the free movement of traffic, controls, flagmen, or similar devices to efficiently control traffic movement shall be provided.

3. Protections of Finishes

A. The various materials, work, equipment, and finishes provided by the several trades are all to be protected from other operations or work so that all items are in perfect condition at the time project is turned over to the Owner. The final responsibility for this protection rests with the General Contractor even though various sections of the specifications may contain specific comments or precautions about protection.

4. Reference Documents

A. Building Code: Reference to *Code,* or to *Building Code,* or to specific code sections, not otherwise identified, means International Building Code (IBC) — 2015 Edition together with additions, changes, amendments, and interpretations in force on the date of the contract. Nothing in the drawings or in these specifications is to be construed as requiring or permitting work that is contrary to code requirements.

B. Standard Specifications: Standard specifications, codes, rules, and regulations referred to in these specifications by basic name of designation only, shall be considered to be of the latest issue with all amendments, as of the date of these specifications. Whenever a date of issue is shown, that particular issue shall govern. Whenever the initials only of a Society or Association are used, the following organizations are referred to:

NBFU	National Bureau of Fire Underwriters
NFPA	National Fire Protection Association
ASTM	American Society for Testing and Materials
AASHTO	American Association of State Highway and Transportation Officials
AWWA	American Water Works Association
AWS	American Welding Society
ACI	American Concrete Institute
AISC	American Institute of Steel Construction

C. State Highway Specifications: Wherever in these specifications reference is made to *State Highway Specifications,* it shall be understood to refer to the Standard Specifications of the State of California, Department of Transportation, with all additions and revisions thereto.

5. Examination of Site

A. Data in these specifications and on the drawings are as accurate as possible, but are not guaranteed. The Contractor shall verify locations, levels, distances, and features of the site and related improvements that may affect the work. No allowance will be made in his behalf for any extra expense resulting from failure or neglect in determining the conditions under which work is to be performed.

6. Telephones

A. The Contractor shall provide and pay for all necessary temporary telephones. Telephones shall be in continuous service available at all times, free and unrestricted, to Architect's and Owner's representatives for calls in direct connection with the work. All such temporary telephones shall be removed upon completion of the work.

7. Tests and Inspections

A. All tests and inspections required by these Specifications will be performed by a person or testing laboratory employed by the Contractor with the prior approval of the Architect.

8. Layout

A. Principal lines, levels, and control stakes shall be established by a Registered Civil Engineer or Licensed Surveyor employed by the Contractor, except that upon submission of adequate proof by the Contractor that the Contractor is capable of performing this work and his assumption of full responsibility for its accuracy, the requirements may be waived by the Architect. Such lines and points shall be marked and maintained as required by the Architect for construction and inspection purposes.

9. Shop Drawings

A. Five copies of material lists, schedules, and brochures as required under the various sections shall be submitted to the Architect for approval. One reproducible copy of all drawings shall be submitted sufficiently in advance of the work to allow for selection of colors and patterns and coordination of the work shown with related work. Drawings shall be clearly marked with the name of the project and name of the Contractor. These requirements apply to original submittals and to any resubmittals that may be necessary, and shall be as further specified in General Conditions Article 4. The reproducibles will then be forwarded to the Contractor for the Contractor's use.

10. Dust Control

A. The work includes dust control as required to abate any dust nuisance on and about the site which is the result of construction activities. Dust control shall consist of the application of water by means of approved sprinkling equipment to the extent and in the amounts required at any time, including weekends and holidays, that dust control is necessary. The use of chemicals, oil, or other palliatives will not be permitted.

11. Cleaning

A. The Contractor shall at all times during the course of this contract keep the buildings, the Owner's premises, and the adjoining premises, including streets and driveways, free from accumulations of waste materials and rubbish caused by his employees or work or by the employees or work of his subcontractors. Rubbish shall not be buried on the Owner's premises. At completion of the work, or prior thereto if so directed, the Contractor shall remove from the buildings and the premises all tools, appliances, surplus materials, debris, temporary structures, temporary construction, and rubbish, and shall be responsible for clean-up of the work as well as work under other contracts affected by his work. Cleaning, polishing, sealing, waxing, and all other such finish operations noted on the drawings or required in the specifications shall be taken to indicate the required condition at the time of acceptance of work under the contract. At completion of work, the Contractor shall sweep and clean thoroughly, shall clean all glass, removing all paint, stains, etc. therefrom without scratching or injuring the glass, and shall leave the work bright, clean, and polished. All marks, stains, fingerprints, dust, dirt, paint, drippings, and the like shall be removed throughout the building; waxed work shall be polished, plumbing fixtures shall be washed clean, all hardware and other unpainted metals shall be cleaned and polished, all equipment and paint work shall be cleaned and touched up if necessary, and all temporary labels, tags, and paper coverings shall be removed, all to the approval of the Architect and the Owner. Finally, the exterior of the building, the grounds, approaches, railings, fences, equipment, planting, etc. shall be similarly clean and in good order at time of final acceptance of the building, with paint fresh, coatings unbroken, hardware clean and polished, and planting well established, neatly trimmed, and in good condition. If the Contractor, upon request by the Architect, does not attend to such cleaning with responsible promptness, the Owner may cause such cleaning to be done by others and charge the cost of the same to the Contractor or deduct the said cost from payments still due the contractor under the contract.

12. Safety

A. Precaution shall be exercised at all times for the protection of persons (including employees) and property. The safety provisions of applicable laws, building codes, and construction codes shall be observed. Machinery, equipment, and all hazards shall be guarded or eliminated in accordance with the safety provisions of the latest edition of the manual of Accident Prevention in Construction, published by the Associated General Contractors of America, to the extent that such provisions are not in contravention of applicable law. The Contractor shall protect all hazards with adequately constructed guard rails or barricades and shall provide lanterns, warning lights, and the like, as necessary. The Contractor shall eliminate all attractive nuisances from the work and from the site. To this end, the Contractor shall so dispose, store, guard, and protect the premises and all work, materials, equipment, and both permanent and temporary construction as to preclude the unauthorized use thereof by children or others and particularly to eliminate possible consequent injury to all unauthorized persons. In no case shall the Owner or Architect be responsible for construction means, methods, techniques, sequences, or procedures or for safety precautions and programs in connection with the work, nor shall the Owner or Architect be responsible for Contractor's failure to employ proper safety procedures.

13. Scaffolding and Hoists

A. The Contractor shall furnish and maintain hoists, staging, rigging, scaffolding, and runways required in the prosecution of the work under this contract. Such temporary work shall be erected, equipped, and maintained in accordance with statutes, laws, ordinances, rules, or regulations of the State of California or other authorities and insurance companies having jurisdiction and shall be approved by the State of California.

14. Dewatering

A. The Contractor shall furnish and maintain all pumps or other dewatering devices which may be required by the work under this contract.

15. Construction Fence

A. If no suitable fence exists, Contractor shall erect an 8-foot-high chain link fence around the site, with necessary gates. Remove at project completion. If suitable fencing exists, the Contractor shall be responsible for any additional fencing, gates, or relocation for construction purposes, and for any fees or permit costs during the construction period.

16. Job Sign

A. Furnish and erect two 96" x 96" job signs painted and lettered to identify the Project, the Owner, the Architect, the Contractor, and four Consulting Engineers. Mount on posts and brace as directed by the Architect before commencing.

17. Insurance

A. As per Article 11 of the General Conditions, the Contractor's insurance limits of liability for bodily and personal injury, occupational sickness or disease, or death shall not be less than $500,000.00 for each person, and subject to that limit for each person, not less than $1,000,000.00 for each occurrence. The limit for property damage liability shall not be less than $500,000.00.

18. Index of Drawings

A. The list of drawings is shown on Sheet 1 - Sheet Index.

19. Project Office

A. Provide and maintain, for the duration of the Contract, a project office, complete with heat, light, ventilation, and convenience outlets. Office shall be of sufficient size for Contractor's personnel and operations and shall provide desk space for use of the Architect and inspection personnel.

20. Temporary Toilets

A. Provide temporary toilet facilities for all personnel employed on the project. Toilets shall be maintained in a clean and sanitary condition at all times. Remove at project completion.

21. Construction Water and Power

A. Contractor shall make arrangements for all water and power required for the project. Provide all temporary lines and pay all bills. Remove temporary facilities at project completion.

22. Premises and Fees

A. All permits, assessments, and fees shall be paid for by the General Contractor including but not limited to:
   1. Electric permit and service
   2. Plumbing permit and service
   3. Building permit
   4. Street cut fees
   5. Sewer connection charges
   6. Water connection fees

23. Utilities

A. Contractor to notify all applicable utility companies, including those listed on the accompanying Drawings, and to verify all utility grades, locations, and crossings before beginning construction. Start of construction without a written report to the Architect of any discrepancies assumes acceptance of the site conditions by the Contractor and claims for extra work involving these utilities will be the responsibility of the Contractor.

B. The Contractor is expected to use reasonable caution when trenching in the vicinity of lines shown, and in the event of damage to them, will be responsible for their prompt repair or other acceptable temporary means of maintaining service until permanent repairs can be made.

C. All work on this project shall be so conducted as to permit utility companies to maintain their services or install additional facilities without interruption.

LESSON 9 QUIZ

1. When preparing specifications relating to moisture control, an architect should rely on

   A. manufacturers' literature.

   B. the local building code.

   C. personal judgment and experience.

   D. all of the above.

2. Construction work is divided among the construction trades in accordance with

   I. the specifications.

   II. the drawings.

   III. trade union rules.

   IV. the general contractor's judgment.

   A. IV only **C.** III and IV

   B. I, II, III, and IV **D.** I, II, and III

3. Which type of information is NOT normally contained in construction drawings?

   A. Dimensions

   B. Level of quality

   C. Quantities

   D. Configurations

4. Shop drawings provide the architect with information on which of the following? Check all that apply.

   A. Installation details

   B. Equipment operating data

   C. Color and texture

   D. Standard of workmanship

5. A Project Manual contains

   I. drawings.

   II. general conditions of the contract for construction.

   III. instructions to bidders.

   IV. sample contract administration forms.

   V. the bid form.

   A. II and IV

   B. I, III, and V

   C. II, III, IV, and V

   D. I, II, III, IV, and V

6. All of the following statements about descriptive specifications are true EXCEPT

   A. they describe desired end results.

   B. they make the architect responsible for proper performance of the specified items.

   C. they explain all components of the specified items in detail.

   D. they describe the arrangement and assembly of the components of the specified items.

7. Cash allowance specifications

   A. require the contractor to set aside money in the bid to be applied to the cost of an item of work once the level of quality is known.

   B. provide that the owner will obtain a discount for construction materials purchased with cash.

   C. provide that the owner will be rebated a cash amount for each specified item that the contractor can buy at a discount.

   D. establish a fixed price for each unit of material so that a final bid amount can be calculated once quantities are known.

8. When selecting mechanical systems for a project, the architect and mechanical engineering consultant should consider which of the following factors?

   I. Skill of the owner's maintenance staff

   II. Weight of the equipment

   III. Noise characteristics of the equipment

   IV. Operating clearances

   A. II and IV
   C. III only
   B. II, III, and IV
   D. I, II, III, and IV

9. Reference specifications are

   A. comprehensive specification checklists to which an architect refers at the start of each new job.

   B. used by architects to refer contractors to federal or other standard specifications that are to apply to work on the project.

   C. proprietary systems like MasterSpec® to which architects may subscribe.

   D. useful because they do not have to be updated once the initial research is done.

10. All of the following statements about performance specifications are true EXCEPT

    A. they include test parameters for the items specified.

    B. they make the contractor responsible for proper performance of the specified items.

    C. they explain all components of the project.

    D. the specified items are in detail.

    E. they are best used for new or unusual situations.

11. Which type of information is NOT normally contained in construction specifications?

    A. Level of quality

    B. Quantities

    C. Desired performance

    D. Installation methods

12. When evaluating substitutions proposed by the contractors, an architect should consider all of the following factors EXCEPT

    A. the terms of the warranty.

    B. code compliance.

    C. projected maintenance costs.

    D. equipment required for installation.

13. Which of the following statements concerning master specifications is FALSE?

    A. They tend to reduce repetitive clerical work.

    B. They are usually edited by adding appropriate sections.

    C. They can be difficult to keep accurate and up-to-date.

    D. They make initial draft specifications available early in a project's development.

14. Proprietary specifications

A. are supplied by product manufacturers on loose sheets of paper for architects to bind into project manuals.

B. are usually *open*, but may be *closed* on private projects.

C. contain full technical data on the products specified.

D. contain no trade names.

15. Plumbing drawings have all of the following characteristics EXCEPT

A. they are diagrammatic.

B. they are frequently superimposed on blank architectural floor plans.

C. they graphically show the physical dimensions of pipes.

D. they indicate connections between pipes.

LESSON TEN

10

CONSTRUCTION CONTRACT ADMINISTRATION

GENERAL CONCEPTS

Introduction

Construction contract administration encompasses a wide range of services performed by an architect after completion of the bidding or negotiation phase, and extending up to and sometimes beyond completion of the construction of the project. Use of the terms *supervision* and *inspection* to describe the architect's services during the construction phase should be avoided because of potential professional liability problems. Supervision should be left to the contractor and inspection to building department inspectors and testing agencies. It should be recognized that there is no single word to describe all the services customarily performed by an architect during the construction phase.

The single best source of information about an architect's customary construction phase services—construction contract administration—is found in the AIA Owner-Architect Agreement (Document B201). Article 2.6 describes in detail what is expected of an architect during the construction phase. This description of services is paralleled in the AIA General Conditions of the Contract for Construction (Document A201). Throughout this course, references are made to these two important AIA Documents.

For this course, for the licensing examination, and throughout an architect's professional career, familiarity with the provisions in these two standard AIA documents is a fundamental

requirement. Therefore, candidates should initially scan both documents, especially the index of the AIA General Conditions, so that the material in this course can be studied in context. Much of the material in this course will explain the provisions in the AIA documents.

Principles of Agency Law

An *agent* is defined as someone who is authorized to act on behalf of another party, the *principal*. Both persons and corporations can act as agents for other persons or corporations. The authority of an agent is usually established by an agreement between the parties, but it can also be determined by the agent's conduct and implied conditions.

During the construction phase, an architect normally performs construction contract administration as the owner's agent. In order to avoid liability problems, the agreement between the architect and the owner should spell out the scope of the architect's *agency* and establish that the architect is authorized to act on behalf of the owner only to the extent set forth in the contract. In the absence of a written contract, the scope of the architect's agency will be implied or determined by general principles of law. When the architect is acting as an agent for the owner, it is important that the owner's identity be disclosed, because an agent can be held personally liable if he or she acts on behalf of an undisclosed principal. This can have direct implications in regard to who is responsible for paying for the construction work, among other things.

Standard Contract Requirements

The scope of the architect's role as the owner's agent is established by Subparagraph 2.6.1.1 in AIA Document B201:

> *The Architect shall provide administration of the Contract between the Owner and the Contractor as set forth below and in AIA Document A201-2007, General Conditions of the Contract for Construction.*

Note that this provision about the scope of the architect's construction contract administration services is in the Owner-Architect agreement, but it makes a direct reference to the General Conditions, which is part of the Owner-Contractor agreement. The reason for this is both simple and important: the Owner-Architect agreement establishes the scope of the architect's authority to act as the owner's agent, and the contractor is informed about this authority by parallel provisions in the General Conditions of the contract for construction. The contractor would not normally see the Owner-Architect agreement because he or she is not a party to it. It would make little sense for the architect to be authorized to act as the owner's agent during construction if the contractor were not informed about the architect's role and thus unaware that the architect could act on behalf of the owner in this manner.

Article 2.6 of B201 describes the contract administration services an architect agrees to provide. Compensation for the architect's services is provided for in Article 6 of B201. Exceeding the scope of these services opens the architect to potential liability and financial loss. Certain services, such as redesign caused by changes in the owner's program, may be provided for additional compensation (see B201, Paragraphs 3.3 and 3.3.1). Other services, such as offering legal or insurance advice, should not be provided at all.

The architect must know and understand the contract terms that establish the scope of his or her agency. Because he or she is the owner's representative, the architect must be careful not to act in a way that either causes problems for the owner or creates a professional liability exposure. For example, the contract normally gives

the architect the authority to reject work that does not conform to the requirements of the contract documents (B201, Subparagraph 2.6.2.2, and A201, Subparagraph 4.2.6), but the architect usually would not have authority to stop the work without independent written authorization from the owner. Serious consequences, such as claims for delay or the potential claims by workers injured during the course of construction, can arise from the architect's right to stop the work. This has led to the elimination of the contract language that formerly gave the architect the right to stop the work. *Only the owner can order the work to be stopped.*

In addition, the construction contract makes the contractor responsible for construction means, methods, techniques, sequences, procedures, and for safety precautions in carrying out the work. Therefore, the architect, as the owner's agent or otherwise, should not involve himself or herself in *how* the contractor performs this work—only whether the work performed meets the requirements of the contract documents. The architect should also avoid direct contact with subcontractors and suppliers, except in accordance with the provisions of the contract documents. For example, A201, Subparagraph 9.6.3, permits the architect to furnish subcontractors with information on the percentages of completion or the amounts of payment applied for by the contractor. If the architect deals with subcontractors outside of permissible contract bounds, he or she can become liable for interfering with the contractor's contractual relationships with subcontractors.

When an owner requires extensive representation by the architect at the site, the architect may assign one or more of his or her staff as Project Representative(s). The duties, responsibilities, and limitations of the authority of the Project Representative are described in B207. These services are compensated as a Change in Services.

The architect customarily engages consultants, such as structural, mechanical, and electrical engineers, to provide services as part of the Owner-Architect Agreement. A properly prepared Architect-Consultant Agreement (C401) binds the consultant to the architect according to the same terms as the architect is bound to the owner.

Professional Liability Coverage

Professional liability insurance protects an architect against claims which may arise out of his or her negligent acts, errors, or omissions during the performance of professional services. It is sometimes called *errors and omissions* insurance or *malpractice* insurance. Although this insurance is very costly, most established firms carry it. Sophisticated clients, such as corporations and some government agencies, often require, as a condition of the Owner-Architect Agreement, that the architect have professional liability insurance.

As with any insurance policy, the professional liability policy contains exclusions to limit certain types of claims for which the insurance does not apply. Some exclusions are quite broad, such as the exclusion for claims arising out of any express warranties or guarantees that the architect may have agreed to. Other exclusions apply to specific aspects of rendering services, such as claims arising out of cost estimates being exceeded.

Professional liability insurance covers the architect's liability for professional *negligence*. Negligence is defined as a failure to meet the ordinary *standard of care* expected of an architect under the same or similar circumstances as those associated with actual allegations of negligence in a specific case. Before an architect can be found liable for negligence, a plaintiff (the person bringing the claim) must allege and prove that there was a legal duty owed by

the architect, the architect breached that duty (the architect did something he or she should not have done, or failed to do something he or she should have done), and the breach of the duty was the proximate cause of (was somehow directly related to) actual injury or damage suffered by the person bringing the claim. All of these factors must be present before an architect can be found liable for negligence. Because an architect's professional liability is based on the law of negligence, professional liability insurance policies do not provide coverage for intentionally wrongful acts.

During a trial, the professional standard of care is determined by the testimony of expert witnesses—usually other architects—who are knowledgeable about what is ordinarily expected of an architect under the circumstances. The testimony of expert witnesses plays a significant role in determining whether liability is imposed on an architect for damages or injuries that occur during the course of a project.

GENERAL LEGAL PRINCIPLES

Liens

A *mechanic's lien* is a legal claim against someone's property. Liens are authorized by statutes in every state to protect people who expend labor or provide materials to improve someone else's property. Because the labor or materials cannot be repossessed once they are incorporated into the property, the right to a lien protects the worker's right to payment. If the recipient of the labor or materials fails to pay for them, his or her property can be attached by a lien to ensure that there will be collateral for the debt. Thus, the property itself becomes the security for the money owed if it is not otherwise paid, and if the claimant is forced to go to court to collect. After a mechanic's lien is filed, the claimant still must file a lawsuit to prove his or her right to payment and to get a court order to foreclose on the property.

Mechanics' liens are carefully defined by statute, and all statutory requirements must be complied with or the lien may be invalidated. Lien statutes customarily require that liens be filed within 30 to 90 days, depending on the jurisdiction, after the last work is performed or materials are installed. Some jurisdictions require subcontractors to file a notice of lien before they can actually file a lien. In all jurisdictions, general contractors have lien rights. Whether or not lien rights extend to sub-subcontractors or material suppliers depends on the lien laws of the jurisdiction in which the project is located. Architects' lien rights vary from state to state. In a few states, architects have absolutely no right to a lien for any architectural services. In others, the project must proceed into construction before an architect has lien rights. And, in other states, an architect can assert a lien even if only design services have been performed, if he or she is not paid. As noted, the lien laws vary considerably from state to state, and they must be checked carefully before a lien is filed. Since the ARE is a national exam, questions on lien laws are general in nature.

In order to protect the owner from liens if a contractor fails to pay his or her subcontractors or material suppliers, the standard AIA contract documents set up several layers of protection. If liens are actually filed, or if the architect learns that liens may be filed, the owner must get his or her attorney involved. After all, it is the owner's property against which the lien claimants are asserting their claims. However, the architect must be familiar with lien-related concepts, because both the owner and his or her attorney often will seek technical advice from the architect.

The first level of protection for the owner to guard against liens involves the *retainage*. By withholding (retaining) a small percentage of the money owed to the contractor, as the construction progresses, the owner will have funds to pay for labor or materials if the contractor fails to make payment. Retainage also can be used to pay for the correction of work performed improperly. Obviously, once the work has been performed properly and all bills have been paid, the retainage must be paid to the contractor at the end of the construction phase. However, the retainage should never be reduced or released without the written permission of the surety company that issued the performance bond for the contractor. This will be covered later in detail in the discussion on Bonds and Insurance. Retainage is provided for in the AIA Owner-Contractor Agreement, Document A101, Article 5. In addition, Subparagraph 9.5.1 in the AIA General Conditions (A201) states in part:

> *The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner... because of:*
>
> *.2 third party claims filed or reasonable evidence indicating probable filing of such claims;*
>
> *.3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;...*

Therefore, if the architect has information that the contractor is not paying his or her bills, he or she can require adjustments in the contractor's Application for Payment to withhold funds to protect the owner.

Another level of protection for the owner is to require the contractor to provide a Labor and Material Payment Bond. This is a bond that guarantees payment for labor and materials if the contractor fails to pay for them. This will be covered in detail later in this lesson.

A further level of protection is to require the contractor to submit an affidavit and releases of liens before the contractor is entitled to receive final payment, and in some cases progress payments, from the owner. This is provided for in the AIA General Conditions (A201) in Subparagraph 9.10.2 which states in part:

> *Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied,...and (5) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all moneys that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.*

In order to facilitate receipt of the contractor's affidavit and release of liens, the contractor can submit properly completed copies of AIA Document G706, Contractor's Affidavit of Payment of Debts and Claims and AIA Document G706A, Contractor's Affidavit of Release of Liens. These documents include a notarized statement by the contractor that all subcontractors, material suppliers, and others have been paid. Any exceptions must be noted

in the form. In addition, the form requires the contractor to attach separate releases or waivers of liens from subcontractors and materials or equipment suppliers to the extent required by the owner. There is no AIA form for the release of lien required from subcontractors, but most contractors have developed their own forms. In general, they require the subcontractor or supplier to state that he or she has been paid for all labor and materials for the project and that he or she releases all rights to assert a lien against the property. If the contractor is unable to secure a release of lien from all subcontractors or material or equipment suppliers, he or she can provide a lien bond to protect the owner from loss in the event a lien is filed.

All of the above procedures—retainage, bonds, and releases of lien—are designed to protect the owner from having to pay twice for labor or materials. If the owner pays the contractor, but the contractor fails to pay his or her subcontractors or suppliers, the latter parties can assert a lien against the owner's property. If they are successful in proving their claim of nonpayment, the owner must either pay them directly, or else risk losing his or her property. Because mechanic's liens have serious consequences, the law and standard AIA contract documents provide important protections that must be understood by the architect as part of his or her construction phase services.

Arbitration

The architect's specific role in the arbitration process will be covered later in this lesson. In general, arbitration is widely used in the construction industry as a means of resolving disputes. Examples of arbitration clauses can be found in standard AIA documents dating back to the late 19th century. Today, standard construction industry documents typically require mandatory, binding arbitration of any unresolved disputes that arise between the parties to the contract. The arbitration proceedings usually are conducted under the auspices of the American Arbitration Association (AAA), but the parties can agree to non-AAA arbitration. The AAA has developed a set of Construction Industry Arbitration Rules to govern the arbitration process. (See Figure 10.1 for a sample Demand for Arbitration form.)

In all but a few states, contract clauses requiring arbitration of *future* disputes are valid and binding. In a few states, arbitration clauses are not binding in regard to future disputes, but even in those states, the parties can agree to binding arbitration *after* a dispute arises. The courts generally take a very liberal attitude toward arbitration and normally will require matters to be arbitrated if there is any basis for doing so, such as an agreement between the parties to arbitrate their disputes. No one can be compelled to arbitrate if he or she has not agreed to arbitration, but once there is an agreement to arbitrate, it is very difficult to avoid arbitration.

The standard AIA contract documents contain a broad arbitration clause calling for arbitration of any claim or dispute. These clauses can be found in Paragraph 4.3 of the AIA Owner-Architect Agreement (B102) and in Paragraph 15.4 of the AIA General Conditions (A201). Note that AIA Document B201 incorporates AIA General Conditions (A201) by reference.

In arbitration, the arbitrator hears the arguments and evidence presented by each party, and he or she then makes a decision based on the facts and the law as he or she understands them. The arbitrator is not required to give any reasons for his or her decision, and the decision is final and binding and cannot be appealed except on very narrow grounds such as fraud or collusion between the arbitrator and a party. Once the arbitration has been held, the case normally is over, regardless of the outcome.

TYPICAL ADVERTISEMENT FOR BIDS

American Arbitration Association

CONSTRUCTION INDUSTRY ARBITRATION RULES

To institute proceedings, please send three copies of this demand and the arbitration agreement, with the administrative fee as provided in the rules, to the AAA. Send the original demand to the respondent.

DEMAND FOR ARBITRATION

DATE: Sept. 30, 1998

TO: Name Empire Trust Company, Inc.
(of the Party on Whom the Demand Is Made)

Address 255 Royal Way

City and State Kingville, ME ZIP Code 04226

Telephone (207) 555-3282 Fax (207) 555-3283

Name of Representative _____
(if Known)

Representative's Address _____

Name of Firm (if Applicable) _____

City and State _____ ZIP Code _____

Telephone ( ) _____ Fax _____

The named claimant, a party to an arbitration agreement contained in a written contract, dated May 20, 1998 and providing for arbitration under the Construction Industry Arbitration Rules of the American Arbitration Association, hereby demands arbitration thereunder.

THE NATURE OF THE DISPUTE: Under the contract dated May 20, 1998, Smith Brothers Construction Co., Inc. demands payment of $90,000, such sum representing final payment due on construction contract with Empire Trust Company, Inc. Empire Trust Company contests this demand, claiming that construction of its building is not complete by virtue of several unresolved problems.

THE CLAIM OR RELIEF SOUGHT (the Amount, if Any): $90,000 plus interest at the rate of 12 percent per annum.

Please indicate the industry category of each party.

CLAIMANT: ☐ Owner ☐ Architect ☐ Landscape Architect ☐ Engineer ☒ Contractor
☐ Subcontractor (Specify. _____) ☐ Interior Designer ☐ Other _____

RESPONDENT: ☒ Owner ☐ Architect ☐ Landscape Architect ☐ Engineer ☐ Contractor
☐ Subcontractor (Specify. _____) ☐ Interior Designer ☐ Other _____

HEARING LOCALE REQUESTED: Kingville, ME
(City and State)

You are hereby notified that copies of our arbitration agreement and this demand are being filed with the American Arbitration Association at its Bangor, ME office, with a request that it commence administration of the arbitration. Under the rules, you may file an answering statement within ten days after notice from the administrator.

Signed Karl Klink Title Attorney
(May Be Signed by a Representative)

Name of Claimant Smith Brothers Construction Co., Inc.

Address (to Be Used in Connection with This Case) 6506 Broadway

City and State Bangor, ME ZIP Code 04401

Telephone (207) 555-3663 Fax (207) 555-3664

Name of Representative Karl Klink

Name of Firm (if Applicable) Klink, Blink, and Fink, Attorneys

Representative's Address 65 Moop St.

City and State Bangor, ME ZIP Code 04401

Telephone (207) 555-8274 Fax (207) 555-8275

☐ **MEDIATION is a nonbinding process. The mediator assists the parties in working out a solution that is acceptable to them. If you wish for the AAA to contact the other parties to ascertain whether they wish to mediate this matter, please check this box (there is no additional administrative fee for this service).**

Form CI2-6/93

Figure 10.1

The standard arbitration clause states that the award shall be final, and judgment may be entered upon it in any court having jurisdiction.

Even though the standard AIA documents call for mandatory arbitration, there is no general legal requirement that the parties must agree to arbitration. It is not uncommon in non-AIA contracts for the arbitration clause to be eliminated. The parties can always agree not to arbitrate even after signing a contract containing an arbitration clause. If there is no agreement to arbitrate, the dispute or claim must be dealt with in court, as with any other legal matter.

There is no way to determine beforehand whether arbitration or litigation is preferable. The AIA and other construction industry organizations have decided that arbitration is preferred, and they have therefore included arbitration clauses in their standard contract documents. For each supposed advantage of arbitration there may be arguments to the contrary. Nonetheless, arbitration is considered advantageous because it is usually quicker than a trial, it can be less costly, the matter can be heard by an arbitrator who has expertise in the construction industry, and it is private. This last factor is a particular benefit to architects who normally are concerned about their professional reputations and want to avoid court proceedings that are a matter of public record.

BONDS AND INSURANCE

General

The term *risk management* acknowledges that risk is ever present during the design and construction phases of a project. Since no one wants unnecessary exposure to risk, there are several forms of protection available. They include: programs to prevent loss (such as TQM, or Total Quality Management), bonds to guarantee performance, insurance to pool risk, liens to obtain payment, and retainage to ensure completion and correction of deficiencies. Examples of risk and available protection include:

- A shored embankment gives way and a crane plunges into the excavation, causing injury and property damage.

  The contractor is protected by liability insurance and workers' compensation insurance.

- A subcontractor goes bankrupt from accumulated losses on previous projects, causing workers and material suppliers to go unpaid.

  The owner is protected by the contractor's labor and material payment bond.

- Material shipped from overseas is mishandled, causing breakage and shortage of critical building components on the construction site.

  The contractor is protected by his or her liability insurance, and the owner is protected by his or her "builder's risk" insurance if he or she has paid for the material.

- An architect specifies toilet fixtures which do not comply with the Americans with Disabilities Act, causing the owner to replace all the fixtures to avoid potential lawsuits.

  The architect is protected by professional liability insurance if he or she is found to be negligent. However, given the high deductibles in most such policies, this expense would most likely be paid out of pocket.

- A contractor is the low bidder on a project but refuses to enter into an agreement, causing the owner to accept a higher bid and to delay the start of construction.

  The owner is protected by the contractor's bid bond or bid deposit.

Although bonds and insurance are often discussed together, and both are provided by the insurance industry, there are fundamental differences between the two. A *bond* is essentially a guarantee—the bonding company's role being similar to that of a co-signer on a bank loan. The *surety*, the party that issues the bond, guarantees that the *principal*, the contractor, will perform certain acts to be undertaken for the benefit of the *obligee*, the owner. There is no expectation of loss with a bond, since the owner, contractor, and surety all believe the contractor is capable of properly performing the work. If they did not, presumably, the owner would not hire the contractor, the contractor would not agree to undertake the work, and the surety would not agree to issue the bond. Despite this confidence, bonds are usually required because of the significant financial risk associated with most construction projects.

Insurance, on the other hand, anticipates the possibility of loss and is written with the expectation that events will occur to cause a loss. However, it is not known which individual in a group of insureds will suffer the loss. By pooling relatively small amounts of money—the premiums—a large sum can be aggregated to pay or compensate those members of the group of insureds who suffer a loss. As with automobile or home insurance, the relatively small premiums paid by all car or home owners enable the insurance company to pay out large sums to the relatively few individuals who are involved in car accidents or whose homes burn down or are burglarized. Now we will discuss specific forms of construction bonds and insurance.

Bid Bonds

A bid bond is a bond furnished by a bidder, as part of his or her bid submission, to guarantee two things:

1. That the bidder will, in fact, enter into a contract with the owner at the price and on the terms stated in his or her bid; and
2. That the bidder will provide a performance and labor and material payment bond to guarantee that the work will be properly carried out and paid for.

If the bidder fails to do these two things, the surety or bonding company is liable for any extra costs, up to the penal amount of the bond, incurred by the owner in good faith in order to enter into a contract with another contractor.

Occasionally, the bid documents may permit bidders to submit a certified check in some stated amount, possibly 5% of the bid, or a set dollar amount in lieu of a bid bond. The principle remains the same: if the selected bidder fails to enter into the contract, the owner can use the bid security to pay for any increased costs or other damages suffered by having to contract with another party.

Performance Payment Bonds

The performance bond and payment bond guarantee precisely what their titles indicate—performance of the work and payment for labor and materials. These bonds are discussed together because they are often written on a combined form. (See AIA Document A312, Performance Bond and Payment Bond.)

A312 is a performance bond and payment bond form which combines two separate bonds into one form. It is not a single combined performance and payment bond, however. Certain federal and state laws, called *Miller Acts*, require the use of bonds on public works in

lieu of allowing the contractor mechanic's lien rights. The A312-2010 version was drafted to address concerns from the surety industry about judicial interpretations from various state courts.

The amount of the performance bond normally is 100% of the contract amount. The issuance of a 100% bond indicates that the contractor's surety company believes the contractor can carry out the work. If the contractor requests a lower bond amount, it could suggest that the surety company may not be willing to write a bond for the contractor in excess of a certain limit because the surety does not believe the contractor has the capability to perform that volume of work, either on its own or in combination with other projects under contract.

Sometimes, an owner may decide to eliminate the requirement for a performance bond because he or she believes the contractor has sufficient strength to carry out the work, and the owner is not concerned that the contractor will default on the contract or go out of business. This can result in a saving of between one and one and a half percent of the contract price. Nonetheless, the decision to eliminate the requirement for a performance bond should be made by the owner only after consultation with his or her attorney and other advisors. The architect might be asked his or her opinion about the contractor's stability and for a recommendation in this regard. However, any recommendation should advise the owner about the risk associated with not having a bond, no matter how stable and capable the contractor may appear to be.

In the event of a default by the contractor, the performance bond requires the surety company to either (1) complete the contract in accordance with its terms and conditions, or (2) obtain bids to enable another contractor, under contract to either the surety or the owner, to complete the contract in accordance with its terms and conditions. The surety's financial liability extends to the penal amount on the face of the bond. Under the standard AIA bond form, any suit to enforce the bond must be brought within two years from the date on which final payment under the contract is due.

Not all contractors and their sureties use the standard AIA bond forms, so the owner's attorney and insurance advisors should review the actual bond forms submitted by the contractor to determine what notices may be required, about extensions of time or change orders, for example, and the procedures in the event of a default. Architects' professional liability insurance excludes coverage for claims arising out of giving or failing to give advice about insurance and bonds. Architects can avoid exposing themselves to this uninsured liability by not attempting to interpret bond terminology for their clients.

The labor and material payment bond, as indicated above, protects the owner against claims by subcontractors and suppliers who are not paid by the contractor. This bond gives those parties the direct right to sue on the bond in order to collect payment from the surety. The owner has no liability for any costs or expenses associated with any such suit. The AIA Performance and Payment Bond (A312) extends protection to parties having a direct contract with the contractor, to parties having a contract with a subcontractor of the contractor, and to water, gas, power, light, heat, oil, gasoline, telephone service, and equipment rental directly applicable to the contract. There is no requirement that a claimant must file a lien before attempting to collect payment from the surety company. In fact, suing on the bond is a clear alternative to filing a lien in an attempt to collect from the owner.

With both the performance bond and the labor and material payment bond, the retainage, if any, held by the owner can be used by the surety to reduce its financial losses. In the event of a default or failure of payment by the contractor, the owner must still pay the contract amount. The surety only pays for any excess costs caused by the contractor's default, up to the penal amount of the bond. Because the retainage is viewed as the surety's money in the event of a default, *the retainage should never be reduced or released without the surety's written permission.* Even if things are going smoothly on a project, and a reduction or release of retainage is in order, the contractor could be in trouble on other projects. In that case, the surety probably would want to monitor all of the contractor's finances. To facilitate getting the surety's permission for a reduction or release of retainage, AIA has developed two forms: Consent of Surety to Reduction in or Partial Release of Retainage, Document G707A, and Consent of Surety Company to Final Payment, Document G707. These two forms alert the surety that the retainage will be released upon the surety's consent and that the surety's obligations remain intact even though this money will be paid to the contractor. If the surety has any objections to this, it can refuse to execute the documents. In that case, the retainage should not be reduced or released. The consent of the surety to final payment is a contract condition contained in Subparagraph 9.10.2 of the AIA General Conditions (A201).

Contractor's Insurance

Construction contracts normally require the contractor to carry various types of insurance to protect against risks or liabilities associated with the construction of a project. This insurance is important because it can protect the owner and architect, as well as the contractor, from claims or financial loss in the event of injury or damage during the course of the work. When insurance is in effect, claimants normally look to the insurance for a prompt settlement of their claim. Without insurance, however, lawsuits are often filed in an attempt to collect damages from any party with assets who might have been responsible for causing the problem.

The AIA General Conditions require the contractor to carry several different types of insurance to protect against loss from various categories of potential claims. It is the owner's responsibility to stipulate which types of insurance coverage and the limits of coverage the contractor must carry for the project. Often, because of the architect's experience from previous projects, the owner will ask the architect for advice about insurance coverage and limits. The architect should *never* give insurance advice, because he or she is not an insurance agent or broker and his or her professional liability insurance does *not* cover claims arising out of the giving of insurance advice. Instead, the architect should offer to assist the owner's insurance agent in determining which and how much insurance is appropriate for the project. The architect can tell the owner what his or her experience on prior similar projects has been, but the architect should make it very clear that he or she is not making any recommendations about insurance for the specific project, and that the final decision about insurance must be made by the owner on the basis of professional insurance advice.

To assist the architect in dealing with the owner on matters of insurance, as well as to document the owner's instructions about insurance coverages and limits for the project, AIA has developed Document G612, Owner's Instructions to the Architect. This form is in a checklist format that can be used by the owner and his or her insurance agent to decide which bonds and insurance will be required, as well as the limits of coverage. After the form is completed by the

owner, it is sent to the architect to be inserted into the bidding and contract documents for the project.

Another useful AIA document in establishing insurance requirements is the Guide for Supplementary Conditions, Document A503. The insurance requirements in the AIA General Conditions are general insurance requirements. These provisions must *always* be supplemented in the Supplementary Conditions to establish specific project insurance requirements and limits of coverage. The AIA General Conditions can never be used without appropriate Supplementary Conditions in regard to insurance requirements. The AIA Guide for Supplementary Conditions (A503) provides guidance and useful sample language in this regard.

To provide a detailed analysis of bonds and insurance, AIA publishes *Construction Bonds and Insurance*, by Bernard B. Rothschild, FAIA. This publication is a detailed analysis of bond and insurance requirements contained in the AIA standard construction documents, and it includes sample contract language, a glossary of insurance terminology, and sample insurance policies.

By law, all employers must carry workers' compensation insurance to protect employees in case of job-related injuries. Therefore, the contractor is required, by Subparagraph 11.1.1.1 of the AIA General Conditions, to carry this coverage for his or her construction workers. The theory behind workers' compensation insurance is that workers suffering job-related injuries should be able to get a prompt and fair insurance settlement, instead of having to bring a lawsuit to recover damages for their injuries. The employer is required by law to pay the premiums for workers' compensation insurance. These premiums are included in the contractor's overhead costs and are therefore reflected in his or her bid prices.

By statute, the employer who is required to pay the workers' compensation insurance premium is given immunity from a separate lawsuit by the worker who collects the insurance benefit after an injury. The worker, however, is not precluded from suing any other party who might have been responsible for the injury. Thus, an architect may be sued directly by a construction worker after he or she is injured and collects workers' compensation insurance benefits. Because the worker cannot sue the contractor, the injured worker can look for a third party to sue (i.e., the architect) if he or she does not feel the insurance has provided adequate compensation.

These *third party suits* are based on the idea that the architect somehow had a legal duty to properly direct and manage the construction work. If the plaintiff can establish that the architect had this duty, and that the architect breached the duty, the architect can be held liable for the injuries. For this reason, the word *supervision* should *never* be used to describe the architect's construction phase services, or as a synonym for construction contract administration. Several court decisions have held that *supervision* means a right to manage, direct, and control. When supervision is used in the context of a construction project, it is intended to describe the contractor's function—the contractor, and not the architect, directs, manages, and controls the construction work. If the architect has a contractual obligation to *supervise*, he or she can be held liable for any injuries or damage that occur because he or she failed to properly direct, manage, and control the construction work. Thus, to avoid liability to construction workers and to limit their recovery for job-related injuries to the workers' compensation insurance, an architect should

not undertake, by contract or otherwise, any duties that might be interpreted as part of the contractor's scope of work.

Other liability insurance required of the contractor covers claims by his or her employees that are not covered by workers' compensation insurance, claims by non-employees because of bodily injury, sickness, or disease, and claims for damages insured by the usual personal injury liability coverages (i.e., libel, slander, etc.). In addition, the contractor is required to carry insurance for claims for damages other than to the work itself (an adjacent building, for example) and for claims arising out of the ownership, maintenance, or use of a motor vehicle. The contractor's workers' compensation insurance, employer's liability insurance, comprehensive general liability insurance, personal liability insurance, and automobile liability insurance policies normally protect against the claims described above.

An important adjunct to the contractor's insurance coverages is required by Subparagraph 11.1.1.7 of the AIA General Conditions (A201). This provision requires the contractor's insurance to include contractual liability insurance applicable to the contractor's obligations to indemnify and hold the owner and architect harmless from certain types of claims, as set forth in Paragraph 3.18 of the AIA General Conditions. Indemnification is an agreement between two parties not to hold one of the parties liable for future legal action or fines. Contractual liability insurance provides coverage for a liability assumed by contract. A contractual provision calling for indemnification is a contractually assumed liability. Paragraph 3.18 requires the contractor to indemnify the owner and architect if they are sued by a construction worker who is injured during the course of the work. By requiring contractual liability insurance, usually written by an endorsement to the contractor's comprehensive general liability policy, the owner and architect can be assured that there is a party with financial responsibility—the insurance company—standing behind the contractor's obligation to indemnify them in the event of this type of claim.

Owner's Insurance

The owner has an insurable interest in the work as it progresses. Under the provisions of the AIA General Conditions and many non-AIA construction contracts, title to the work passes to the owner each month as the owner makes the progress payments to the contractor. Therefore, it is considered appropriate for the owner to carry the insurance on the property itself. On occasion, the contractor, rather than the owner, will be required to carry the property insurance. This occurs when the owner is relatively unsophisticated and does not want to have the responsibility for the property insurance or when the contractor can arrange this coverage more conveniently than the owner can. In any event, it should be recognized that the AIA General Conditions place the responsibility for carrying the property insurance with the owner. If the contractor is to carry the property insurance, the AIA Guide for Supplementary Conditions (A503) contains suggested language to achieve this objective.

The property insurance is sometimes referred to as the *builder's risk* or the *builder's risk-all risk* insurance. Because the insurance is often carried by the owner, the term *builder's risk* is a misnomer. In addition, the coverage is defined by the policy terms, conditions, and exclusions, so it does not literally cover *all* risks. And, this coverage can be written on a specified perils basis rather than on an *all risk* basis. The function of the property (or *builder's risk*) insurance is to protect the property itself against such risks as fire, theft, vandalism, and malicious mischief. Typically, the coverage is

written for the full insurable value of the work on either a completed value or a reporting form. The completed value is coverage for the full value of the work, with a single premium paid. The reporting form requires a monthly adjustment as the value of the work increases during construction. If it is to be for a lesser amount, the owner is obligated to notify the contractor prior to commencement of the work so that the contractor can arrange his or her own coverage to further protect himself or herself and the subcontractors. The cost of arranging this latter coverage can be charged to the owner. The AIA General Conditions also requires the owner to maintain boiler and machinery insurance, if required by the contract documents or by law.

If a loss occurs that is covered by the property insurance, the owner is required to act as a trustee for the insurance proceeds received in the event of a covered loss. If the contractor is carrying the property insurance, the contractor would act as the trustee in the event of a loss. The owner is required to pay the contractor, and the contractor in turn to pay the subcontractors, a just share of the insurance proceeds received in settlement of claims. Funds received in settlement of claims should be placed in a separate account, pending distribution to the parties.

Normally, if a loss occurs, the owner or his or her attorney will become involved, but they may look to the architect for technical assistance. The architect should limit his or her involvement to providing professional advice. He or she should not attempt to determine the rights of the respective parties, act as a custodian for the insurance proceeds, or make any determination about how the proceeds are to distributed. These decisions must be made by the owner on the basis of advice from his or her attorney.

The architect should be aware of the concept of subrogation. *Subrogation* is a procedure by which an insurance company, after it pays a loss to its insured, can attempt to recover this amount from some other party who may have actually caused the loss. An insurance company cannot recover from its own insured, whether or not the insured was at fault. However, if someone else was at fault, the concept of subrogation enables the insurance company to "step into the shoes" of its insured in an attempt to recover its loss.

The standard AIA General Conditions contains a *waiver of subrogation* clause (Subparagraph 11.3.7) that precludes the parties from seeking to recover any money from each other for any loss covered by the property insurance. Because the parties are waiving their rights to recover from each other, the property insurance company would not have any right to do so either, since the insurance company has no greater rights than its insured. Most insurance policies prohibit the insured from waiving any rights *after* a loss occurs, but it is not customary for the policy to prohibit this prior to the occurrence of a loss. Presumably, if the insurance company is aware of the contract terms calling for the waiver, it can determine the appropriate premium, knowing that it will not be able to offset any amount paid out in the event of a loss.

Another aspect of the property insurance involves occupancy of the work by the owner prior to substantial completion. If it becomes necessary for the owner to occupy the work prematurely, the contractor and the company providing the property insurance must agree to this. The insurance company's consent must be evidenced by an endorsement to the insurance policy.

The above discussion covers the standard property insurance coverages for a typical project. Neither the owner nor the contractor is limited to the standard coverages. If special project requirements or personal concerns of either party necessitate additional coverages, the parties can consult their insurance agents and arrange whatever insurance is appropriate to protect against the risk of loss.

Certificate of Insurance

The Certificate of Insurance is a memorandum that outlines the types and limits of the insurance coverages carried by the contractor for the project. Subparagraph 11.1.3 of the AIA General Conditions (A201) requires the contractor to provide certificates of insurance acceptable to the owner. The certificates must contain a provision stating that the owner will be given written notice at least 30 days before the underlying insurance policies can be cancelled. The notice requirement gives the owner and the contractor a reasonable opportunity to arrange replacement coverage or effect a termination of the contract if replacement insurance cannot be arranged.

AIA has developed Document G715, Supplemental Attachment for ACORD Certificate of Insurance 25-S, to facilitate the communication of this information. The certificate of insurance must be filed with the owner before the work commences. If the certificate is sent by the contractor to the architect, the architect should promptly forward it to the owner with instructions that it be reviewed by the owner's insurance agent to determine whether the contractor's insurance coverages comply with construction contract requirements.

The Certificate of Insurance is normally prepared and signed by the contractor's insurance agent, and there can be no guarantee that he or she studied the contract requirements carefully before completing the form. There is always the possibility that the contractor's insurance agent simply listed on the certificate of insurance the coverages normally carried by the contractor, rather than the coverages required by the contract documents. The owner's insurance agent, and not the architect, should analyze the certificate of insurance for compliance with contract requirements. If it does not appear that the contractor's insurance is in compliance, the architect should be notified immediately so that he or she can inform the contractor not to commence work until the proper insurance is arranged. If the required insurance is not in effect prior to the commencement of the work, there is a risk that an uninsured loss could occur.

There is no requirement in the AIA General Conditions that the owner must file a Certificate of Insurance with the contractor. Thus, there is no AIA form to serve as a certificate for the insurance carried by the owner for the project. However, Subparagraph 11.3.6 of the AIA General Conditions requires the owner to *file with the Contractor a copy of each policy that includes insurance coverages required* of the owner before an exposure to loss occurs. In other words, for those insurance coverages carried by the owner, the contract requires the owner to give a copy of each policy to the contractor. Here, too, the architect's role is limited to transmitting the documents. The architect should not make any substantive judgments or recommendations about the adequacy of the owner's insurance. If the contractor has any concerns in this regard, he or she should direct them to the owner, via the architect.

SUBCONTRACTORS AND MATERIAL SUPPLIERS

Subcontractors and material suppliers are parties who have contracts with the general contractor to provide labor and/or materials required in connection with the work. There is no contractual relationship between the owner or the architect and subcontractors and material suppliers. Contractors generally are very sensitive about their contractual relationships with subcontractors and material suppliers and object to any interference by the architect with these relationships. Except under narrowly prescribed circumstances, the architect should not communicate directly with subcontractors and material suppliers. All such communication should be directed to and through the contractor. Likewise, all communications from subcontractors and material suppliers also should come through the contractor to the architect. This is particularly appropriate in regard to shop drawing and sample submittals, which should not be accepted by the architect if they have not been checked and approved by the contractor first.

Article 5 of the AIA General Conditions requires the contractor, as soon as practical after the contract is awarded, to give the owner and the architect written notice about the subcontractors that the contractor proposes to use for major portions of the work. Although the owner does not have a right of prior approval for subcontractors, the contract gives the owner and the architect the right to raise reasonable and timely objections to any subcontractors or material suppliers. If the owner or the architect has a reasonable objection, the contractor is precluded from contracting with any such party. In that case, the contractor must subcontract with someone else, and the owner will be liable for any increased costs. Paragraph 5.3 of the AIA General Conditions (A201) requires that all subcontracts be in writing so that the subcontractor is bound to the contractor, to the extent of the work to be performed, to the same extent as the contractor is bound to the owner. If the contract is based on documents other than the standard AIA General Conditions, the architect should review the contract carefully to determine the scope of his or her authority in regard to approving or rejecting subcontractors and material suppliers.

As noted above, the architect should refrain from communicating directly with subcontractors and material suppliers. It may seem expeditious for an architect to speak directly with a subcontractor or field superintendent in order to give instructions, discuss changes, or evaluate the quality of construction. If the architect does this, however, the architect risks a claim by the contractor that the architect's communication has increased costs, caused delay, or otherwise interfered with the contractor's ability to properly supervise and manage the construction process. All such communications should be directed by the architect to the contractor, with some minor exceptions which will be discussed elsewhere.

ARBITRATION

General arbitration concepts have already been covered in detail, but there are also several related aspects of dispute resolution during construction contract administration that directly involve the architect. Under standard contract documents, the architect serves as the initial decision maker when disputes arise between the owner and the contractor, and the architect can be called as a witness in any ensuing arbitration proceeding.

Architect's Role as Initial Decision Maker

The standard AIA Owner-Architect Agreement (B201) requires the architect to interpret the drawings and specifications and make decisions on matters in question between the owner and contractor. Subparagraphs 2.6.2.3 and 2.6.2.4 state:

The Architect shall interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests shall be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

> *Interpretations and decisions of the Architect shall be consistent with the intent of and reasonably inferable from the Contract Documents and shall be in writing or in the form of drawings. When making such interpretations and decisions, the Architect shall endeavor to secure faithful performance by both Owner and Contractor, shall not show partiality to either, and shall not be liable for results of interpretations or decisions rendered in good faith.*

These provisions are paralleled in the AIA General Conditions in Subparagraphs 4.2.11 and 4.2.12, which bind the owner and the contractor to initially refer claims, disputes, and other matters in question to the architect for a decision. Because the architect is familiar with the contract documents and does not have an economic interest in the construction contract, the law gives the architect limited immunity when the architect serves in the role of an initial decision maker after such disputes or claims arise. The architect cannot be held liable for the consequences of any decisions made in good faith, regardless of whether the decisions favor the owner or the contractor. The architect may not show partiality to either party when serving in this role.

The architect's decisions and interpretations must be consistent with the intent of, and be reasonably inferable from, the contract documents. If the matter in question involves aesthetic effect, the architect's decision is final, if consistent with the intent of the contract documents. Other decisions are subject to arbitration or mediation upon written demand by either the owner or the contractor. See Article 15 of the AIA General Conditions. After a matter is referred to the architect for a determination, the architect must act within specified time limits. Neither party can demand arbitration until the architect has rendered a written decision or until 10 days after the parties have presented their evidence to the architect, if the architect has not rendered a decision by that time. These limitations do not apply if the position of architect is vacant, if the claim relates to a mechanic's lien, or under various other circumstances. The time within which the parties must demand arbitration of a dispute depends on the nature of the architect's decision. If the decision is in writing and states that it is *final but subject to mediation and arbitration* (AIA General Conditions, Subparagraph 15.4). Subparagraph 15.2.6.1 states that either party within 30 days from the date of an initial decision, demand in writing that the other party file for mediation within 60 days of the initial decision.

The architect's role as the initial decision maker is a logical extension of the architect's role as the party who prepared the drawings and specifications. Being familiar with the documents, the architect normally can make a prompt and knowledgeable determination, based on the intent of the contract documents, when either the owner or the contractor has a question or when a dispute arises between them about contract requirements. Except in regard to aesthetic

effect, the architect's decisions are always subject to appeal by a demand for arbitration. If both the owner and the contractor are satisfied with the architect's decision, the matter is resolved, and no one will incur the expense and inconvenience of having to refer the matter to an outside party for resolution. If either party is dissatisfied with the architect's decision, he or she has the option of demanding arbitration. If the architect were not permitted to make initial determinations, every question or dispute would have to be referred to an outside party whenever the owner or the contractor disagreed about the intent of the contract documents.

Architect as a Witness

In the AIA Owner-Architect Agreement (B201), Subparagraph 3.3.1.8 describes the architect's services in connection with any dispute resolution proceeding or legal proceeding involving the project. This service is performed as a Change in Services, with the architect being compensated for his or her time to prepare and serve as a witness or perform other services.

The architect could be called as a witness due to knowledge of facts connected with the project, or the architect could be called as an expert witness because of technical expertise as a design professional. As an expert witness, the architect's function is to aid the court or arbitration panel by giving testimony about technical matters that may be beyond the scope or knowledge of the judge, jury, or arbitrator who will be deciding the case. Often, this involves testimony about the *professional standard of care* during the performance of services or *customary practices* in the construction industry in regard to the issues in question.

It is important to recognize that, when testifying as an expert witness, the architect must be factual, objective, and knowledgeable about construction industry practices related to the issues under deliberation. The architect must base the testimony on an adequate independent investigation of the facts before forming an opinion. Otherwise, the architect risks being embarrassed on cross-examination and having his or her credibility as a witness and a professional seriously undermined.

LESSON 10 QUIZ

1. AIA Document B201, the Owner-Architect Agreement, gives the architect the right to do which of the following?

   A. Determine construction techniques and procedures

   B. Reject work not conforming the requirements of the contract documents

   C. Stop work without written authorization from the owner

   D. Have unlimited direct contact with subcontractors and material suppliers

2. The architect's legal status in representing the owner's interests during construction is defined in

   A. the Owner-Architect Agreement.

   B. the Owner-Contractor Agreement.

   C. the General Conditions.

   D. A and C

3. Professional liability coverage insures the architect against

   A. claims arising out of any express warranties or guarantees to which the architect agreed.

   B. claims arising because of cost estimates being exceeded.

   C. professional negligence.

   D. intentionally wrongful acts.

4. Which of the following statements concerning mechanic's lien laws is INCORRECT?

   A. General contractors have lien rights.

   B. Subcontractors have lien rights.

   C. Material suppliers have lien rights.

   D. Mechanic's lien laws are uniform from state to state.

5. Which of the following actions may an owner take if a construction contract calls for a retainage? Check all that apply.

   A. Use the money to pay for labor or materials if the contractor fails to make these payments

   B. Use the money to pay for the correction of work performed improperly

   C. Hold back money from the contractor at the owner's discretion

   D. Reduce or release the retainage entirely without the written permission of the surety company that issued the performance bond for the contractor

6. AIA Document A201, the General Conditions, requires that, in order to receive final payment from the owner, the contractor must

   A. submit to the architect an affidavit that all payrolls, bills, etc., connected with the work have been paid.

   B. obtain consent of surety to final payment.

   C. if required by the owner, submit other data establishing payment by furnishing receipts, releases, and waivers of lien arising out of the contract.

   D. do all of the above.

7. A formal decision-making process where the decision is final and binding is called _____.

8. A bond involves which of the following parties?

   I. The surety—the party that issues the bond
   II. The principal—the contractor
   III. The obligee—the owner
   IV. The obligator—the architect

   A. I, II, III, and IV
   B. I, III, and IV
   C. I, II, and III
   D. II and IV

9. When a bid bond is furnished by the low bidder, who subsequently fails to enter into a contract with the owner at the price and on the terms stated in the bid,

   A. the surety is liable for the additional cost incurred by the owner to enter into another contract.
   B. the owner must sue the low bidder for the additional costs.
   C. the second lowest bidder pays the surety the difference in cost between his or her bid and the lowest bid.
   D. the owner and the contractor must enter into arbitration to determine the extent of the penalty under the bond.

10. The amount of the performance bond is normally what percentage of the contract sum?

    A. 75%
    B. 50%
    C. 66 2/3%
    D. 100%

11. Construction contracts normally require which of the following parties to carry liability insurance?

    I. The contractor
    II. The owner
    III. The architect
    IV. The mortgagee
    V. The bonding company

    A. I only
    B. I and II
    C. V only
    D. I, II, III, IV, and V

12. Under which circumstances should the architect *supervise* construction?

    A. Whenever possible
    B. Never
    C. Only if the contractor agrees to otherwise *manage, direct, and control* the project
    D. Only if no one else is available for this task

13. The owner must obtain the approval of which of the following parties if he or she wishes to occupy the work prior to substantial completion?

    I. The contractor
    II. The architect
    III. The insurance company
    IV. The surety

    A. I only
    B. I and III
    C. I, II, and III
    D. III and IV

14. The owner normally carries builder's risk (or builder's risk-all risk) insurance because

    A. it is required in the Owner-Contractor Agreement.

    B. it is required in the Owner-Architect Agreement.

    C. no builder can be trusted entirely to perform all of the required work.

    D. title to construction work passes to the owner in increments as payments are made for each portion of the work.

15. On a construction project, there is a disagreement as to whether a specified paint has been properly mixed to match the color sample submitted by the contractor. Who is responsible for interpreting the specifications and making a determination regarding the correct color?

    A. The architect

    B. The contractor

    C. The owner

    D. An arbitrator

GLOSSARY

The following glossary defines a number of terms, many of which have appeared on past exams. While this list is by no means complete, it comprises much of the terminology with which candidates should be familiar. You are therefore encouraged to review these definitions as part of your preparation for the exam.

A

abutment A buttressing or supporting structure.

acoustics The branch of physics that deals with sound. In architectural application, the sound qualities of a room or space.

acropolis In an ancient Greek city, a citadel, usually on a high plateau.

addenda Statements or drawings that modify the basic contract documents after the latter have been issued to the bidders, but prior to taking of bids.

addition (to the contract sum) An amount added to the contract sum either by an accepted additive alternate or by change order.

adobe A sun-dried brick of earth, used in the American Southwest.

advertisement for bids Published public notice soliciting proposals for a construction project.

aesthetics The branch of philosophy that deals with the quality, aspects, and perception of beauty.

agent One who acts on behalf of another.

air rights The rights to the use or control of space above a property, such as highways, railroad tracks, or buildings.

albedo Reflectivity measured as the relative permeability of a surface to radiant energy flowing in either direction.

alignment Horizontal or vertical deviation from the straight or level centerline of the road.

alternate bid Proposal by a bidder for an amount to be subtracted from, or added to, the base bid if the corresponding change in the work is accepted.

Americans with Disabilities Act (ADA) Federal civil rights legislation that establishes the right of persons with disabilities to equal access to sites and buildings and sets design guidelines for its implementation.

amphitheater An arena encircled by tiers of seats.

annunciator An electromagnetic device that indicates the activation of certain circuits; a device to signal the existence and location of a fire in a building.

application for payment A contractor's written request for payment of the amount due on account of work completed and/or materials suitably stored on the site. *Also called* payment request.

approved equal Material or method that is approved by the architect as being equivalent to what was originally specified.

apse The eastern or altar end of a church, usually semicircular in plan.

arbitration An alternative to litigating a dispute, in which one or more arbitrators hears the evidence and renders a decision.

as-built drawings *See* record drawings.

ashlar Masonry having a face of square or rectangular stones.

azulejo A glazed decorative tile with the color blue most prominent.

B

backfill Earth or other fill material placed between an outside foundation wall and the excavation.

baffle A partial obstruction against flow in a duct or pipe.

balance The proportioning of components by offsetting or contrasting so as to produce an aesthetic equilibrium in the whole.

Baroque A style of European architecture developed in the late Renaissance in reaction to classical forms, containing elaborate curves, scrolls, and ornament.

barrier-free provisions Regulations that provide for accessibility to buildings and sites for persons with disabilities.

base bid The sum of money stated in the bid for which the bidder offers to do the work, not including any alternate bids.

base lines East-west lines from which townships are established on government surveys. They run perpendicular to meridian lines.

basic services The architectural services normally required for a building project, usually consisting of schematic design, design development, construction documents, bidding or negotiation, and construction contract administration.

bat A part, usually half, of a broken brick; also a unit of flat insulation.

batten A cleat-like member placed across a series of boards to tie them together; also, a narrow strip covering the joint between two vertical boards.

belvedere A roofed structure or pavilion located to command a view.

bench An excavated level terrace in a slope used to collect running water.

benchmark A relatively permanent surveyor's mark of known location and elevation.

berm A bank of earth, often piled up against a wall.

bid A proposal by a contractor to do the work required by the contract documents for a stipulated sum of money.

bid bond A surety bond guaranteeing that the bidder will sign a contract, if offered, in accordance with his or her proposal.

bidding documents The invitation to bid, instructions to bidders, the bid form, and the contract documents.

bituminous Describing cement, mastic, or roofing material that contains asphalt as a principal ingredient.

blighted area An area, usually urban, that has deteriorated in quality and value, and which functions well below its economic and social potential.

block A division of urban land, normally private property, that is surrounded by public streets, and which is officially established and recorded.

bollard A stone guard to prevent damage to a wall; also, a freestanding stone or metal post to divert vehicular traffic.

bond *See* surety bond.

bonus and penalty clause A provision in the construction contract for payment of a bonus to the contractor for completing the project prior to a specific date, and for a charge (penalty) against the contractor for failing to complete the project by that date.

boring Drilling into the earth to obtain soil samples in order to determine soil bearing capacity.

brise-soleil A sun break, an architectural shading device for blocking unwanted sun rays.

BTU British thermal unit, the amount of heat required to raise the temperature of one pound of water 1°F.

building line A defined limit within a property line beyond which a structure may not protrude.

C

caisson An air chamber without a bottom, used in excavation through water or mud.

campanile A bell tower.

cant To set at a slant from the horizontal or vertical.

carrel A small room in a library.

cash allowance An amount included in the contract sum to cover the cost of certain items not specified in detail. Hardware and other finish items are often handled in this manner.

catch basin A sieve-like device at the entrance to a storm sewer to trap matter that could block up the sewer.

catchment A geographical area from which the participants in an activity are drawn, such as the customers of a shopping center or the employees of a manufacturing plant.

caulk (or calk) To fill a joint with mastic, usually done with a pressure gun.

cella The inner enclosed room of an ancient temple.

certificate for payment A statement by the architect informing the owner of the amount due the contractor on account of work completed and/or materials suitably stored.

certificate of occupancy A document issued by the governing authority stating that a building complies with applicable laws and permitting occupancy for its designated use.

certificate of substantial completion A document prepared by the architect stating that the work is substantially complete, thereby establishing the date of substantial completion. It generally fixes the time within which the contractor must complete the unfinished work listed.

change in services (of the architect) Professional services rendered by the architect, upon the owner's request, in addition to the basic services identified in the owner-architect agreement. *Also called* extra services.

change order A written order to the contractor, prepared by the architect and signed by the owner, contractor, and architect, that authorizes a change in the work, the contract sum, or the contract time.

channelization The separation of traffic lanes by use of islands or dividers.

check valve A valve in a pipe that permits water to flow only in one direction.

circulation The flow or movement of people, goods, vehicles, etc., from place to place.

clerk of the works The owner's job site representative.

climate The prevailing or average weather conditions of a place as determined over a number of years.

clinker A brick that has been overburned by being near the fire in a kiln.

cloverleaf A type of grade-separated interchange used in highway design. Named for its shape.

cluster A method of residential siting in which a series of housing units are grouped to form common interior spaces, as well as a unified peripheral space.

collector street A street to which minor streets connect and that, itself, leads to a major arterial.

color The sensation resulting from stimulation of the retina of the eye by light waves of certain lengths; the property of reflecting light of a particular wavelength.

completion bond A bond obtained by the contractor or owner that guarantees that the project will be completed free of liens.

comprehensive services The architect's basic services expanded to include certain additional services, such as programming, land use studies, etc.

concave Hollow and curved inward (e.g., the inside surface of a hollow sphere).

conductivity The speed with which energy (normally heat energy) passes through a given material after penetrating its surface.

coniferous Pertaining to cone-bearing trees and shrubs, mostly evergreens, such as pine, spruce, fir, cedar, etc.

constellation pattern A pattern of land use in which random clusters of development are connected to one another.

construction budget The sum established by the owner as available for construction of the project. *See also* project budget.

construction change directive A document, signed by the owner and the architect, that authorizes a change in the work, the contract sum, or the contract time. Used when there is not complete agreement on the terms of a change order. *See also* change order.

construction documents Working drawings and specifications.

construction management (CM) Management services performed by the architect or others, over and above normal architectural services, that contribute to the control of time and cost in the construction of a project.

consultant An engineer or other specialist retained by the architect to provide specified professional services to the architect that the architect is required to provide to the owner under the owner-architect agreement.

contingency An amount of money set aside in a budget to cover unanticipated expenses.

contingency allowance An amount included in a construction budget, normally 5 to 10%, to provide for unforeseen or unpredictable costs.

contour An imaginary line of constant elevation on the ground surface used to designate elevation and describe the form of land surface graphically.

contract documents Working drawings, specifications, addenda, general conditions of the contract, supplementary conditions, and the owner-contractor agreement.

contract sum The total amount payable by the owner to the contractor, as stated in the owner-contractor agreement, for performing the work under the contract documents.

contract time The period of time within which the work must be completed, as established in the contract documents.

convection The distribution of energy (normally heat) by fluid movement of air or water.

convex Curved outward (e.g., the surface of a sphere).

cost plus fee contract An agreement under which the contractor, or the architect, is reimbursed for his or her costs and, in addition, is paid a fee for his or her services.

covenant A deed restriction that regulates land use, construction materials, appearance, and aesthetic qualities of an area.

craze To develop minute surface cracks in stucco, concrete, or glaze.

critical path method (CPM) A project management procedure in which all events and operations are charted in a way that establishes the optimum sequence and duration of operations.

CSI MasterFormat A systematic listing of construction trades, materials, systems, and administrative requirements published by the Construction Specifications Institute (CSI) for the purpose of organizing construction specifications.

cul-de-sac A short road with no outlet, serving only those buildings or properties that front on it.

culvert A length of pipe, running under a road or other barrier, used to drain or carry water.

curb A raised margin running along the edge of a street pavement, usually of concrete.

cut and fill Earth that is removed and earth that is added in grading.

D

dais A platform raised above floor level.

date of substantial completion The date, certified by the architect, when the construction is sufficiently completed, in accordance with the contract documents, so that the owner can occupy the project or specified area of the project for the intended use.

datum A horizontal plane elevation used as a reference for other elevations in surveying and mapping.

Davis-Bacon Act A federal law that requires the Department of Labor to set prevailing wages for government-financed construction projects.

deciduous Shedding leaves annually, as contrasted with evergreen.

deed A written instrument that is used to transfer property title from one party to another.

density A measure of the number of people, families, etc., that occupy a specified area.

deposit for bidding documents A deposit of money required of each bidder as security for the bidding documents, to ensure the return of the documents by unsuccessful bidders.

design The arrangement of parts, details, form, color, etc. so as to produce a complete entity.

dew point The temperature at which air becomes saturated with moisture and condensation occurs.

direct expense Expense items directly incurred by, or attributable to, a specific project.

direct personnel expense (DPE) Salaries and wages attributable to a specific project, plus benefits, such as employment taxes, insurance, sick leave, holidays, vacations, pensions, and similar contributions and benefits.

Division One The *General Requirements* Division of the specifications that establishes the administrative and procedural duties of the contractor, architect, and owner during construction.

double glazing Two sheets of glass with an air space between, to insulate against the passage of heat or sound.

drainage The system by which excess water and wastes are controlled, collected, transported, and disposed.

drain tile Clay pipe, usually with open joints, to convey water away from a footing or to disperse fluid in a septic tank field.

dry well A pit, usually filled with coarse stone, into which water is conducted for leaching out into surrounding soil.

due care The requirement that a professional exercise reasonable ability and judgment in a specific circumstance, the absence of which constitutes negligence. *Also called* standard of care.

duomo A dome, hence often a cathedral.

dwelling unit An independent living area that includes its own private cooking and bathing facilities.

E

earthwork The modifications involved in altering existing topography.

easement A legal right that an individual or the public may have to use or have access to a portion of another person's land.

effective temperature Sensation produced by the combined effects of absolute temperature, relative humidity, and air movement.

elevation The height above a known point of reference, often taken as the height above sea level.

eminent domain The right of a public agency to expropriate private property for public use.

entasis The slight convexity of a column, used to give an impression of vertical strength.

erosion The gradual wearing away or disintegration of land caused by water running over its surface, wind, etc.

errors and omissions insurance *See* professional liability insurance.

esquisse A preliminary sketch or plan.

estimate A forecast of probable costs, as opposed to a firm bid.

evergreen Having green leaves throughout the year, as opposed to deciduous.

excavation The digging or removal of earth or soil, as for a foundation.

exedra A semicircular open area, with or without a roof, providing a continuous seat.

express warranty A legally enforceable promise made by the warrantor.

expressway *See* freeway.

extra An item of work involving additional cost. *See also* addition (to the contract sum).

extra services *See* change in services (of the architect).

F

facade The exterior face of a building, usually the front.

faience Enameled clay products.

fast track A construction technique in which construction on each phase of a project is begun when its design is completed, without waiting for overall project design completion.

fast-track construction A construction technique by which construction on each element of a project is begun as soon as the design for that element is completed, without waiting for completion of the design for the entire project. Its principal objective is to shorten the overall construction time.

fault The boundary between adjacent rock plates along which movement may take place during an earthquake.

FHA Federal Housing Administration. Founded in 1934 to provide mortgage insurance.

final completion The completion of all work in accordance with the terms and conditions of the contract documents.

fire brick Brick composed of clay not containing any fusible material, which can resist high temperatures.

fire wall A wall resistant to the spread of fire.

float The extra time available for a construction activity above its estimated time duration, without causing any delay of project completion.

floor area ratio The ratio between the gross floor area of a building and its site area.

FNMA Federal National Mortgage Association (Fannie Mae), an agency whose function is to stabilize the housing market by purchasing mortgages or providing mortgage money directly.

form The shape, outline, or configuration of a structure or the parts of a structure that gives it its distinctive appearance.

freeway A high-speed, multiple-lane highway designed to move traffic smoothly and without interruption.

frieze A horizontal band on a vertical surface, located beneath a cornice, sometimes decorated with relief sculpture.

frost line The limit of penetration of soil by frost.

furring Attaching wood or metal strips to a rough wall, to provide a flat plane for the finish or to provide an air space.

G

gazebo A belvedere or viewing place.

general conditions The part of the contract documents that states the rights, responsibilities, and relationships of the parties involved, usually by means of a standard document published by the American Institute of Architects.

general contract The agreement between the owner and the contractor for the construction of a project.

ghetto A specific residential area in which people of a particular ethnic identity are concentrated.

glare Extreme contrast between light and dark in the visual field, which can cause discomfort.

GNMA Government National Mortgage Association (Ginnie Mae), an agency that functions in the secondary mortgage market.

grade The degree of rise or descent of a sloping surface. Also, the act of altering or finishing existing topography.

granolith Concrete used for paving, which uses crushed granite as the coarse aggregate.

greenbelt A belt-like area around a city, reserved for park land, farms, open space, etc.

grid pattern A pattern of land division for development as well as circulation, so named for its shape.

guarantee A legally enforceable assurance of the quality of materials and labor furnished for a project, or of the length of time that a project or a part thereof will perform satisfactorily. *Also called* warranty.

guaranteed maximum cost The amount established by agreement between the owner and the contractor as the maximum cost of performing specified work. *Also called* guaranteed maximum price (GMP) *or* upset price.

H

harmony Agreement or proportionate arrangement of parts in size, color, form, etc.

hippodrome A race course bordered by tiered seating.

hold harmless clause *See* indemnification.

housing The type, arrangement, and quality of dwelling units distributed over a given area.

HUD Department of Housing and Urban Development. Federal agency concerned with all phases of housing activities.

humidity The amount or degree of moisture in an area expressed as a percentage, a determining element of weather.

I

icon A sacred picture or object.

impost The cap of a pier or pilaster that supports the spring of an arch.

incentive clause A clause in a cost plus fee contract between the owner and contractor in which the savings between the guaranteed maximum cost and the actual project cost are proportionally shared.

indemnification A contractual obligation whereby one party agrees to guarantee another party against loss or damage from specified liabilities. *Also called* hold harmless clause.

indirect expense Overhead expense—that is, expenses indirectly incurred and not chargeable to a specific project.

ingress An entrance.

inner city The sections of a large city in or near its center, especially when crowded or blighted.

instructions to bidders Instructions in the bidding documents for preparing and submitting bids for a project. *Also called* notice to bidders.

insurance Coverage by contract (insurance policy) whereby one party (the insurance company) agrees to indemnify or reimburse another (the insured) against loss from a specified hazard. *See also* liability insurance *and* professional liability insurance.

intaglio A surface decoration formed by a slightly depressed plane of lines and patterns.

interchange An access and egress point on a freeway that permits traffic to enter, exit, or change direction.

intersection The point at which two streets come together or cross.

inversion A situation, generally the reverse of normal, in which cold air is close to the ground and a layer of warm air is above it.

invert elevation The elevation of the lowest inside surface of a pipe or sewer.

invitation to bid An invitation to a selected list of contractors soliciting bids for a project.

J

jalousie A window or door blind made of movable horizontal slats.

K

keystone The wedge-shaped top member of an arch.

kiosk A small pavilion, usually in a public place.

L

labor and material payment bond A bond guaranteeing to the owner that the contractor will pay for all labor and materials used for the project.

lanai A Hawaiian terrace or veranda.

landscaping The design and arrangement of natural elements on a site.

lantern A superstructure on a roof, dome, or tower, glazed along its sides, that admits light to the area below.

letter of intent A letter signifying intention to enter into a formal agreement and setting forth the general terms thereof.

liability insurance Insurance that financially protects the insured against liability on account of bodily injury or property damage sustained by another.

lien A legal claim on property, as security for money owed.

light Radiant energy that is perceived by the human eye.

linear pattern A pattern of land use that develops along a line, such as a highway or river.

lintel A structural member placed over an opening and supporting construction above.

liquidated damages A sum chargeable against the contractor as reimbursement for damages suffered by the owner because of the contractor's failure to complete the work within a specified time.

loop street A street that starts at a major street, extends in curvilinear fashion for a short distance, and then returns to the major street.

louver One of several horizontal slats, slanted to exclude rain but allow the passage of air.

lowest acceptable bona fide bid The lowest bid that complies with all the stipulated requirements.

lump sum contract *See* stipulated sum contract.

M

macadam Paving using crushed stone.

macroclimate The general climate over a large geographical area.

manhole A hole through which a person can enter a sewer, pipe, conduit, etc., in order to inspect, repair, or service a utility.

master plan Long range, overall concept of an area's development.

mastic Caulking that remains elastic.

means of egress The elements that comprise an exit to the outside, including aisles, corridors, doors, and stairways.

mechanic's lien A claim on property by those who furnish material or labor for the construction of a building. Clear title to the property cannot be obtained until the claim is settled.

megalith A stone of great size.

megalopolis A term referring to a group of large cities or metropolitan areas that merge.

metes and bounds A description of property boundaries expressed by directions (bearings) and distances.

metropolitan area (or region) The characteristic form of large-scale American urbanization; a city form with an operating radius of 30 miles or more.

microclimate The general climatic characteristics that are peculiar to a very small area.

module A repetitive dimension used in architectural design and planning.

mortgage An agreement to pay for the cost of a property over a long period of time, in which the property is pledged as security.

mullion The vertical division member between windows or doors.

multiple of direct personnel expense agreement An agreement providing for payment for professional services based upon the direct personnel expense multiplied by an agreed factor.

muntin A wood or metal member used to hold the panes within a window.

N

naos An inner chamber of a classical temple.

narthex The entrance vestibule of a church.

nave The main longitudinal portion of a church interior.

neighborhood A community of people living in a general area. The area can generally support an elementary school.

network A system of circulation channels that covers a large area.

notice to bidders *See* instructions to bidders.

O

obelisk A commemorative shaft, square in section, with a small pyramid on top.

observation A term sometimes used for on-site examination of the contractor's work by the architect to determine in general if it is proceeding in accordance with the contract documents.

O.C. An abbreviation for "on-center," used in dimensioning.

option A choice given to the contractor to provide specified alternates without prior approval of the architect.

orientation The positioning of an object in relation to certain directions; the sense of direction as disclosed by an object in a particular position.

overhead expense *See* indirect expense.

P

pagoda In Far Eastern architecture, a tower-like structure.

palazzo A palace.

panopticon A building planned so that a person at the center can observe converging corridors.

parterre A level and patterned garden.

parti The general scheme of a design.

party wall A wall built astride a property line.

patio An open court enclosed by the walls of a building.

payment request *See* application for payment.

pediment The triangular face of a roof gable.

penalty *See* bonus and penalty clause.

percentage agreement An owner-architect agreement under which the professional fee is based upon a percentage of the construction cost of the project.

performance bond A bond that guarantees to the owner that the contractor will perform the work in accordance with the contract documents.

planting strip A landscaped strip of ground dividing a pedestrian walk from a street.

plat A plan of a land area, lots, streets, etc.

plot A parcel of land.

post-completion services Additional services rendered to the owner by the architect following actual completion of the project.

prefabricated Constructed off-site in standardized sections for shipment and quick assembly, such as a prefabricated house.

prime contractor Any contractor on a project who has a contract directly with the owner.

professional liability insurance Insurance that financially protects an architect against claims for damages resulting from professional negligence. *Also called* errors and omissions insurance.

program A written statement of the owner's conditions and requirements for the project.

progress payments Payments made to the contractor during progress of the work on account of work completed and/or materials suitably stored.

project budget The sum established by the owner as available for the entire project, including the construction budget, land cost, equipment cost, financing cost, cost of professional services, and contingency allowances. *See also* construction budget.

project manual The manual prepared by the architect for a project, including the technical specifications, bidding instructions and forms, general conditions, supplementary conditions, special conditions, and other legal and administrative documents.

project representative The architect's representative at the site, who assists in the general administration of the construction contract for a project.

proportion A system of sizing and division to establish harmonious relationships between component elements.

PUD Planned unit development, a zoning designation that allows greater freedom in site planning, while usually maintaining the same density. Similar to cluster developments but larger in scale, including commercial and industrial developments in addition to housing.

punch list A list of items to be corrected or completed, which is provided by the contractor and usually expanded by the architect based on a detailed inspection of the work prior to substantial completion.

R

radial pattern A circulation pattern in which channels spread out from a central point.

rake A slope or incline, as on a roof.

record drawings Drawings revised to show changes made during construction. Sometimes erroneously called *as-built drawings*.

release of lien A legal document signed by a supplier of material or labor for a project, which releases his or her mechanic's lien against the property. *See also* mechanic's lien.

retainage An amount withheld from each payment to the contractor in accordance with the terms of the owner-contractor agreement.

rhythm The recurrence of design elements in space.

right-of-way A path of circulation conveying persons, vehicles, services, etc.

ring pattern A land use pattern that is developed in a circular or doughnut form, the center being relatively unused.

ring road A circumferential or loop roadway around an urban area or development.

rotary A device used at an intersection of streets in which all vehicles merge and then diverge at relatively low speeds.

rotunda A circular space covered by a dome.

runoff coefficient The fraction of total rainfall that is not absorbed in the ground and, hence, runs off. It must be collected in a system of surface and subsurface drains.

S

sample Material or assembly submitted for the architect's approval prior to manufacture or delivery to the project.

satellite In urban planning, an outlying community of secondary importance, dependent on a larger city.

scale The relative measurement of an object, with reference to the dimensions of the human body.

schedule of values A statement furnished to the architect by the contractor reflecting the amounts to be allotted for the principal divisions of the work. It serves as a guide for reviewing the contractor's periodic applications for payment.

separate prime contract One of several owner-contractor agreements for a project, each of which provides for constructing a major portion of the work (general construction, electrical, mechanical, etc.) by a different contractor.

setback A legally defined distance from the property line into which a structure may not project.

sewer An underground pipe or drain used to carry off rainwater (storm sewer) or waste matter (sanitary sewer).

shop drawings Drawings prepared by contractor, subcontractor, manufacturer, or supplier, showing how specific portions of the work shall be fabricated and/or installed.

sick building syndrome A term used to describe poor indoor air quality, which can lead to discomfort and possibly disease.

single prime contract A contract for building construction under which one prime contractor is responsible for the entire project, in contrast to having separate contracts. *See also* separate prime contract.

site planning Designing the external physical environment in which buildings and structures are placed.

slope The amount of deviation from the horizontal or vertical.

slum An urban area that is overcrowded and whose buildings may be unsafe and unhealthful to inhabit.

special conditions Part of the contract documents, other than general and supplementary conditions, describing unique conditions of a project.

specifications Part of the contract documents, comprising written descriptions of materials, construction systems, and workmanship.

spot zoning Zoning of a parcel of land that is different from that of the surrounding area.

standard of care *See* due care.

star pattern A pattern of land use developed in the shape of a star.

statute of limitations An ordinance that specifies the period of time within which legal action must be brought in order to obtain legal relief for damage or injury.

stipulated sum contract An agreement under which the architect or contractor is paid a specific amount as the total fee for services performed. *Also known as* lump sum contract.

stoa A portico used in Greek architecture, often as a covered shopping way.

storm sewer A sewer for carrying away surface rainwater, as opposed to sanitary sewage.

style Specific or characteristic manner of expression, execution, construction, or design in any art, period, work, etc.

subcontractor One who has a contract with a prime contractor to perform a portion of the work.

subdivision The division of vacant land into smaller parcels to be used as sites for individual buildings, together with public rights-of-way affecting these sites.

submittal A shop drawing, project data, or a sample submitted by the contractor to the architect for review prior to incorporation in the work.

subrogation The substitution of one entity for another with regard to legal rights.

subsoil The soil layer beneath the topsoil.

substantial completion As defined in the AIA General Conditions, completion of a project to the point where the owner can occupy all or designated portions of the work for the purpose for which it is intended.

suburb An outlying portion of a city, which is largely residential.

superblock A very large area of land in which all through traffic is eliminated, but which may be penetrated by cul-de-sacs or minor loop roads.

superintendent The contractor's representative at the site.

supervision Direction of the work by the contractor's personnel. Supervision is not the responsibility of the architect.

supplementary conditions Part of the contract documents, prepared by the architect, which may modify provisions of the general conditions of the contract.

surety An individual or company that guarantees to make good to another party the debt, default, or failure to perform of a third party.

surety bond An agreement under which one party (the surety or bonding company) guarantees to make good to another party (the obligee or owner) the debt, default, or failure to perform of a third party (the principal or contractor). *See also* bid bond, labor and material payment bond, *and* performance bond.

survey The process of determining the location, form, and boundaries of a parcel of land by measurement, computation, and drawing.

symmetry A mirror image arrangement of elements on either side of a dividing line or plane.

T

tar A dark sticky oil, dry distilled from resinous woods, coal, or peat; used in roofing and road surfaces.

texture The arrangement of particles of a material that affects the appearance or feel of the surface.

topography The configuration of the surface features of an area of ground.

total quality management (TQM) An approach to the delivery of goods or services in which quality is determined by customer satisfaction and conformance to requirements.

trade discount The difference between the list price and the actual price paid.

U

underpass A road that crosses under another road.

unit price An amount, stated in dollars per unit, provided by the contractor with his or her bid for adding or deleting specific portions of the work.

upset price *See* guaranteed maximum cost.

urban renewal A process of public intervention in the development of an existing urban area, in which the public acquires ownership of property and administers its resale and development to mainly private owners.

utility A public service, such as telephone, water, gas, or electricity.

V

vapor barrier A membrane that prevents the passage of water vapor through a wall or roof.

viaduct A bridge across a valley.

vomitorium An entrance (or exit) passage in a large amphitheater.

W

waiver of lien A document by which one relinquishes the right of mechanic's lien against the property of another. *See also* mechanic's lien *and* release of lien.

warranty *See* guarantee.

water table The level below ground at which water is found flowing.

windbreak Structures or plants that, because of their form and location, reduce wind velocities.

work All materials and/or labor required for a project.

working drawings The part of the contract documents, prepared by the architect, that graphically illustrates the construction required for the project.

X

XCU The exclusion from insurance coverage for liability arising out of (X) explosion or blasting, (C) collapse of or structural damage to a building, and (U) underground damage caused by mechanical equipment.

Y

yard An area of land not built upon, which may be used for exterior activities.

Z

zoning The legal means whereby land use is regulated and controlled for the welfare of the community.

BIBLIOGRAPHY

The following list of books is provided for candidates who may wish to do further research or study in Practice Management. Most of the books listed below are available in college or technical bookstores, and all would make welcome additions to any architectural bookshelf. In addition to the course material and the volumes listed below, we advise candidates to review regularly the many professional journals, which are available at most architectural offices.

Architects and Engineers: Their Professional Responsibilities
Acret
McGraw-Hill

Architect's Handbook of Professional Practice
Three Volumes
The American Institute of Architects

Architectural and Engineering Law
Tomson and Coplan
Reinhold

Architectural Graphics Standards
Ramsey, Sleeper, and Hoke
Wiley

Architectural Working Drawings
Liebing and Paul
John Wiley & Sons

Avoiding Liability in Architecture, Design and Construction
Cushman
John Wiley & Sons

Building Contracts for Design and Construction
Hauf
John Wiley & Sons

Building Construction Costs With RSMeans Data
Plotner
Gordian Group

Case Histories in Construction Law: A Guide for Architects, Engineers, Contractors, Builders
Jabine
Cahners

Construction Bonds and Insurance Guide
Rothschild
American Institute of Architects

Construction Law in Contractors' Language
Stokes
McGraw-Hill

Design Cost Analysis for Architects and Engineers
Swinburne
McGraw-Hill

Dictionary of Architecture and Construction
Harris
McGraw-Hill

Legal Aspects of Architecture, Engineering and the Construction Process
Sweet
West

Legal Pitfalls in Architecture, Engineering and Building Construction
Walker and Rohdenburg
McGraw-Hill

Life Cycle Cost Analysis: A Guide for Architects
The American Institute of Architects

Life Cycle Cost Analysis 2: Using It in Practice
Haviland
The American Institute of Architects

National CAD Standard
National Institute of Building Sciences
American Institute of Architects
Construction Specifications Institute

The Professional Practice of Architectural Detailing
Wakita and Linde
John Wiley & Sons

The Project Resource Manual: CSI Manual of Practice
Fifth Edition
Construction Specifications Institute

Working Drawing Handbook: A Guide for Architects and Engineers
McHugh
Van Nostrand Reinhold

QUIZ ANSWERS

Lesson 1

1. **C** Sole proprietorship is the type of business entity that is easiest to form. It also does not provide any legal protection for the sole proprietor in case of business debt or financial obligations. All business profits or losses are reported on the sole proprietor's personal tax returns.

2. **D** Initial start-up costs are not considered a disadvantage of a partnership business structure. The start-up costs of a partnership are generally not that high. The disadvantages of partnerships include limited liability protection, the exposure to liability caused by another partner, and the necessity of sharing any profits among the partners.

3. **E** The Fair Labor Standards Act details the minimum hourly wages, overtime requirements, and salaried employee qualifications for overtime.

4. **D** Following a code of ethics is associated with implied duty. The other choices relate to stated duty. The AIA Code of Ethics and Professional Conduct provides guidelines and rules for fulfilling an architect's obligations to the public, clients, users of architecture, the profession, and professional colleagues in the building industry. The obligations under the AIA Code of Ethics exist in addition to those required by the rules of professional conduct developed by individual states and other jurisdictions that regulate architectural practice.

5. **A** Canon I: General Obligations from the AIA Code of Ethics and Professional Conduct begins with the following statement: "Members should maintain and advance their knowledge of the art and science of architecture, respect the body of architectural accomplishment, contribute to its growth, thoughtfully consider the social and environmental impact of their professional activities, and exercise learned and uncompromised professional judgment."

Lesson 3

1. **D** The financial health of a firm takes into consideration profitability, liquidity, and solvency. Profitability is the effectiveness of generating more income than expenses; liquidity is the proficiency of converting resources into cash when required; and solvency is the ability to pay bills on time.

2. **D** The total amount of indirect expenses, divided by the total of direct salary expenses (DSE), produces the indirect expense factor. The indirect expense factor is a ratio that typically ranges from 1 to 2. A value of 1.33 would mean that $1.00 in direct salary expense requires $1.33 in indirect, overhead expense, or $1.33 of indirect expense is required for each $1.00 of DSE.

3. **E** For an architect to be successfully sued based on negligence, four conditions must be met:

   1. *Duty*. The architect must have an obligated duty to the suing party.
   2. *Breach*. The architect did something that he should not have done or failed to do something that he should have done.
   3. *Cause*. The actions or non-actions of the architect are the cause of the harm to the party bringing the suit.
   4. *Damage*. Actual harm occurred to the suing party because of the breach by the architect.

   Agency is when a person or entity represents someone else and acts on that person's behalf.

4. **B** Professional liability insurance protects the architect in case some action by the architect causes bodily injury, property damage, or other damage. It can also be called *malpractice insurance* or *errors and omission (E&O) insurance*. It covers problems related to incorrect specifications, mistakes on drawings, and negligence.

5. **A** In statutes of repose, the beginning of the time period during which a legal action must be filed is based on the building's certificate of occupancy or the completion date of construction. In statutes of limitation, the beginning of the time period is based on the discovery of the defect in the project or when an injury occurs.

Lesson 4

1. **D** None of the AIA documents listed requires the architect to maintain project files. However, it is good business practice to do so.

2. **A, B, and D** Tasks A, B, and D are all included in the architect's services during the construction phase under the AIA Owner-Architect Agreement (Document B201). Coordinating the work of contractors and subcontractors (C) is specifically excluded and could expose the architect to professional liability claims.

3. **A** A Project Representative is employed by the architect.

4. **B** A clerk of the works is employed by the owner. See page 211 for an explanation of the difference between a project representative and a clerk of the works. Neither of these should be confused with the contractor's superintendent.

5. **C** Nothing should be thrown away until the expiration of the statute of limitations applicable to the architect's services or to the project.

6. **Contractor** Record drawings, which show field changes during construction that vary from the information in the working drawings, are generally done by having the contractor mark up the changes on a set of prints at the site.

7. **A** See page 25 and Subparagraph 2.6.6.1 of the AIA Owner-Architect Agreement for the architect's responsibilities regarding warranties, which are limited to forwarding the documents from the contractor to the owner.

8. **B** Subparagraph 3.15.2 of the AIA General Conditions states that the owner may clean up and be entitled to reimbursement from the contractor who has failed to clean up as required.

9. **D** If a subcontractor refuses to furnish a lien release to the contractor, there is a strong possibility that the subcontractor intends to file a lien. Therefore, to protect the owner, the general contractor can furnish a new bond.

10. **B** If an owner believes that a project is not progressing fast enough, he or she should ask the contractor for an explanation through the architect, as provided by Subparagraph 4.2.4 of the AIA General Conditions. If the contractor is not responsive, the owner may terminate the contract in accordance with Article 14.

11. **C** See Paragraph 13.5 of the AIA General Conditions for the owner's, architect's, and contractor's responsibilities for special testing. In this case, the owner must pay for the test.

12. **A** See Paragraph 13.5 of the AIA General Conditions for the owner's, architect's, and contractor's responsibilities for special testing. If standards are not otherwise established by the building code, the architect usually includes in

the specifications the standards by which testing will be conducted and evaluated.

13. **D** Professional liability, or negligence, is determined on the basis of the ordinary standard of care (I). If the design works poorly (II), or if the problem could have been avoided by a different design (III), the architect would not be liable, as long as he or she used the ordinary standard of care. If the architect was not careful (IV), that could render him or her liable, since he or she failed to meet the ordinary standard of care.

14. **C** Field reports should include all necessary facts, including who performed the test, the date of the test, and the weather conditions. An architect should never *supervise* the work. C is therefore incorrect and the answer to this question.

15. **A** Once the owner accepts the work as substantially complete, he or she becomes responsible for maintenance. If the work is properly maintained, and a defect becomes apparent within the warranty period, then the contractor is responsible for correcting the defect. In some cases, the owner may obtain a maintenance contract from the subcontractor who installed the work, which is separate from the construction contract.

Lesson 5

1. **D** The construction management delivery method involves an owner who hires a construction manager to work with the architect to resolve constructability and cost issues during the design phase.

2. **C** The design/build entity is typically responsible for the design and construction of a project, based upon requirements established by the owner and issued in the request for proposal.

3. **C** An architect acts as an agent for the owner in the design/award/build and the construction management delivery methods (II and III are the correct answers). An architect acts as a vendor responsible for the cost and construction of a project in a joint venture with a contractor and in the design/build delivery method (I and IV are incorrect).

Lesson 6

1. **A** Activities B and E both terminate at event 3, after which activity C may begin. See page 105.

2. **D** The critical path is the path with the longest total required time. See page 107.

3. **C** Critical path 1 – 2 – 3 – 4 – 5 has a total time of 2 + 2 + 3 + 1 = 8 days.

4. **C** Total construction cost has little to do with the construction schedule. See pages 103–105.

5. **Fast track** Fast track scheduling is appropriate in situations that require minimum construction time. Time savings are achieved by overlapping the production of construction documents with construction activities, with certain portions of the project documented and built in phases.

6. **B** Certain phases of design and production, such as client approval and project bidding, have fixed times. Therefore, the 25% reduction in time would probably come from the construction drawing phase. This would likely lower the overall quality of the construction documents. The construction budget and time would be unaffected.

7. **A** A shortened time schedule may reduce some fixed overhead expenses, such as rent, but it would undoubtedly lead to

higher costs because of overtime work, additional hired help, and/or work that is subcontracted to others. Because of higher labor costs, profit would decrease, and the documents would be adversely affected. See page 125.

8. **D** See pages 99–102.

9. **C** Complexity is generally more critical than size, while cost and quality rarely affect scheduling.

10. **A** Project cost would be increased because of inefficiencies resulting from additional labor and overtime work. See page 125.

Lesson 7

1. **B** Cost, size, and quality are directly interrelated. Therefore, if the construction budget is fixed, the project must be reduced in size or quality. The owner may also rebid the project or decide to spend more money, but a hoped-for decline in prices seems unrealistic. See page 239.

2. **D** It is not the function of the architect to reduce project cost, size, or quality; this is a prerogative of the owner.

3. **C** After advising the owner of the additional costs and reviewing the possible changes that would bring the budget back into line, the architect must allow the owner to choose one or more of the three variables (cost, scope, quality) that must be modified.

4. **A, B, D, and E** The estimator's skill may affect the reliability of the cost estimate, but not the actual costs.

5. **$96 per square foot** The present cost of $80 per square foot will increase in the ratio 1,020/850 = 1.20. Therefore, the actual construction cost will be 80 × 1.20 = $96 per square foot.

6. **D** Off-site costs include costs of improvements outside project property lines, such as utilities. Access road costs are paid for either by the owner or a government agency, depending on the situation.

7. **A** See page 258.

8. **A** See page 246.

9. **B** Increased wage demands are generally a result of supply and demand, as well as inflation. See page 255.

10. **A** Topographic survey fees, as well as fees for other professional services such as soil investigations and architectural services, are always paid for by the owner.

Lesson 8

1. **D** Subparagraph 3.12.4 of the AIA General Conditions specifically states that shop drawings (III) are not contract documents. The architect's rights and responsibilities during the construction phase are referenced in the AIA General Conditions of the Contract for Construction, but the contractor is not a party to the Owner-Architect Agreement (IV). Subparagraph 1.1.1 of the AIA General Conditions specifically includes the specifications, addenda, and supplementary conditions as part of the contract documents (I, II, and V).

2. **Performance bond** A performance bond guarantees proper execution of the work by the contractor. Conversely, a payment bond guarantees payment to the subcontractors by the prime contractor.

3. **C** The various types of construction insurance are discussed on pages 65 to 67. Both the owner and contractor (IV and V) are required to purchase liability insurance by Article 11 of the AIA General Conditions.

4. **A** See page 69 for information about liquidated damages. The AIA Owner-Contractor Agreement instruction sheet advises the parties to include *the amount of damages due for each day lost* in Paragraph 3.3 of the Agreement or in the Supplementary Conditions.

5. **A** Subparagraph 3.11 of the General Conditions requires the contractor to maintain a set of record drawings (A) at the site *marked currently to record field changes and selections made during construction*. A field sketch (C) is used to revise or clarify information shown in the contract documents based on field conditions.

6. **A** See pages 6–8 for information regarding the Project Manual. The General Conditions (II) are either a standard form, such as AIA Document A201, or written by the owner's attorney. An architect should never prepare a contract to which the architect is not a party, such as the Owner-Contractor Agreement (IV). The Specifications (I) are prepared by the architect, but not necessarily the Supplementary Conditions (III).

7. **D** Article 2 of the AIA General Conditions requires the owner to obtain easements and provide copies of construction documents (IV and V). Article 9 requires the owner to pay the contractor (II). The contractor, not the owner, is required to pay the subcontractors (III), and access to the site as an owner's responsibility is implied but not explicitly stated (I).

8. **B** Under the definitions of time in the AIA General Conditions (8.1.1), time is the period allotted for substantial completion of the work (B is correct, C is incorrect). Subparagraph 8.1.4 defines *day* as calendar day (A is incorrect). The date of the contract is often the start of construction time, but may be otherwise if noted in Paragraph 3.1 of the Owner-Contractor Agreement, or if a *notice to proceed* has a different starting date (D is also incorrect).

9. **A** Subparagraph 9.8.4 of the AIA General Conditions states that warranties commence on the date of substantial completion, unless a different commencement date is stated in the certificate of substantial completion (A is correct). See page 73 for a discussion of warranties.

10. **C** See page 70, and subparagraph 9.5.1 of the AIA General Conditions for payment nullification reasons. All of the reasons listed, except for the lender's refusal to release funds (II), are legitimate.

11. **C** See pages 66 to 67. The owner must pay the contractor as stipulated in the contract documents, not necessarily within 21 days after the certificate for payment.

12. **A** See page 174 and Article 10 of the AIA General Conditions for the general contractor's responsibility for site safety.

13. **D** Since substantial and final completion are significant events for the contractor and owner, the architect is required to make detailed inspections prior to certifying completion. Other site visits are not considered *inspections*, since they are less detailed.

14. **B** See page 74 and Paragraph 9.10 of the AIA General Conditions for prerequisites for final payment. Answer B is the incorrect answer we are looking for, because there is no certificate of final *completion*, only a final certificate for *payment*.

15. **A and B** Subparagraph 3.12.5 of the AIA General Conditions requires the contractor to approve shop drawings and 4.2.7 requires the architect to do likewise

(A and B). The owner (C) is not involved in the shop drawing process. Subcontractors may prepare the shop drawings (E is incorrect). The engineers may review and stamp shop drawings, but the AIA General Conditions do not recognize the engineers as entities independent of the architect (D is incorrect).

Lesson 9

1. **D** When preparing specifications, the architect must review the manufacturer's literature to determine if the product specified is appropriate for the application (A). Any specification must at least meet the minimum standards established by the local building code (B). As with all professional services, the architect must rely on his or her own professional judgment and experience when preparing specifications (C). Since A, B, and C are all correct, D is the answer.

2. **C** Although the drawings and specifications organize information, the general contractor divides the construction trades in accordance with trade union rules (III) and business judgment (IV). See page 11.

3. **B** Dimensions (A), quantities (C), and configurations (D) can be determined from the drawings, but the level of quality (B) is indicated in the specifications.

4. **A** Shop drawings show installation details for the actual product to be used in the project (A). Equipment operating data (B) are indicated in product data submittals. Color and texture (C) are shown on schedules and specifications prepared by the architect and may be repeated on shop drawings. Standard of workmanship (D) is stated in the specifications.

5. **C** A Project Manual contains the technical specifications and other contractual and administrative documents, such as those in choices II, III, and IV, but it does not include the drawings (I), although it may contain a list of the drawings.

6. **A** Specifications that describe the desired end result (A) are *performance specifications*. Statements B, C, and D are all true regarding *descriptive specifications*.

7. **A** See page 15 for a discussion of cash allowance specifications.

8. **D** All the factors shown influence the selection of a mechanical system.

9. **B** *Reference specifications* refer to standard specifications that are incorporated into the project specifications by reference, not by actual text. See page 15.

10. **C** *Descriptive specifications* explain all components of the specified items in detail (C). Statements A, B, and D correctly describe *performance specifications*.

11. **B** Level of quality, desired performance, and installation methods (A, C, and D) are contained in the specifications, but quantities (B) are determined from the drawings.

12. **D** The warranty (A), code compliance (B), and maintenance costs (C) must be comparable for a product to be approved as a substitute for a specified product. Installation equipment is not considered by the architect, although if the in-place cost of the product is reduced, the savings may accrue to the owner if the substitution is approved.

13. **B** *Master specifications* are generally edited by *eliminating* information that does not apply to the project, not by *adding* information.

14. **B** *Proprietary specifications* list one or more acceptable products by name. An *open* proprietary specification allows equivalent products not listed to be provided, while a *closed* proprietary specification allows only those products listed to be provided.

15. **C** Plumbing drawings indicate the size of pipes by notation, not graphically. (C is the incorrect statement we are looking for.) Statements A, B, and D correctly describe plumbing drawings.

Lesson 10

1. **B** Subparagraph 2.6.2.2 of the AIA Owner-Architect Agreement specifically gives the architect the authority to reject work that does not conform to the contract documents. The other three actions would expose the architect to professional liability. Choices A and D are specifically excluded from the architect's services in Subparagraphs 2.6.1.2 and 2.6.2.1. Only the owner can stop the work (see Paragraph 2.3 of the AIA General Conditions).

2. **D** Article 2.6 of the AIA Owner-Architect Agreement describes the architect's services during the construction phase. The AIA General Conditions is part of the contract documents between owner and contractor, but also establishes the architect's rights and responsibilities for the contractor's information. See Paragraph 4.2 of the AIA General Conditions. The Owner-Contractor Agreement does not relate to the architect's status.

3. **C** See pages 143 and 144 for a discussion of professional liability coverage.

4. **D** See pages 144 to 146 for a discussion of liens. Lien laws vary considerably from state to state, but general contractors, subcontractors, and material suppliers always have lien rights.

5. **A and B** Retainage on progress payments to the contractor is intended for the owner's protection against the contractor's failure to pay subcontractors or to correct deficient work.

6. **D** See Subparagraph 9.10.2 of the AIA General Conditions for submittals required from the contractor prior to final payment.

7. **Arbitration** See Paragraph 15.4 of the AIA General Conditions for a discussion of arbitration.

8. **C** See pages 148-149 for a general discussion of bonds. The architect is not a party to construction bonds. The owner and contractor both need protection from risk, and the surety provides that protection for a fee.

9. **A** See page 149 for a discussion of bid bonds. Bid bonds are intended to protect the owner from a bidder who fails to sign a contract for the bid price. The owner can collect damages from the surety with greater certainty and expediency than by the other options listed.

10. **D** A performance bond amount of less than 100% indicates that the surety does not believe that the contractor can perform the work according to the surety's standards. The surety may believe that the project is too big for the contractor, or that the contractor has too many commitments to other projects.

11. **B** See pages 151 to 155 and the AIA General Conditions paragraphs 11.1 and 11.2 for a discussion of the owner's and contractor's liability insurance requirements during construction. The Owner-Architect Agreement may require the architect to carry professional liability insurance, but this is not a requirement of the construction contract.

12. B Supervision of construction is excluded from an architect's professional liability insurance. Subparagraph 2.6.1.2 of the AIA Owner-Architect Agreement and Subparagraph 4.2.2 of the AIA General Conditions both state that the architect does not supervise construction, since this is the contractor's responsibility.

13. B See Paragraph 9.9 of the AIA General Conditions for the requirements for partial occupancy by the owner prior to substantial completion.

14. D See Paragraph 11.3 of the AIA General Conditions and page 154 for the requirements for property insurance, which is commonly referred to as builder's risk insurance.

15. A Subparagraphs 2.6.2.4 of the AIA Owner-Architect Agreement and 4.2.13 of the AIA General Conditions both state that the architect's decisions regarding aesthetic effect are final if consistent with the intent expressed in the contract documents.

Architect Registration Examination

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