



# THE PROFESSIONAL PRACTICE OF **ARCHITECTURAL WORKING DRAWINGS**

OSAMU A. WAKITA · NAGY R. BAKHOUM · RICHARD M. LINDE

FIFTH EDITION



WILEY



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**Osamu A. Wakita**

**Nagy R. Bakhoun**

**Richard M. Linde**

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*This book is dedicated to our families, to students of  
architecture, and to the memory of Richard Linde,  
Jakob Wakita, and Baido (Giichi) and Nobue Wakita.*





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# PREFACE

The purpose of this book is to teach techniques; attitudes; computer-aided drafting (CAD); building information modeling (BIM) and Revit, the computer program that makes it possible, as well as the fundamental concepts of architectural working drawings. With the introduction of BIM and Revit, the profession has changed radically, as has the education of architectural drafters. In the past, employees concentrated on CAD; now we must return our focus to architecture. BIM requires our new legions of designers, drafters, and architects to know more about the process of architecture and building components than ever before. The profession of architecture has changed from 20% design and 80% working drawings to 80% constructing a three-dimensional (3-D) model and 20% working drawings. With Revit, when the design development phase of a project is complete, the working drawings are all but complete as well. The projects become front loaded and require a person working in the parametric data of 3-D modeling to have full knowledge of structure, engineering, design, and site grading, to mention just a few of the necessary areas. There is a new approach to the process of creating working drawings: that of a fully parametric system where the software is integrated to aid in the process of drafting. The focus of developing drawings is shifted from the computer to the individual.

Every chapter has been revised with current information. The text is intended to strongly encourage drafters to go beyond the two-dimensional AutoCAD system and start thinking in 3-D, even if they still work in 2-D. It is both critical and essential to move out of your comfort zone to explore the programs that offer a more cohesive system of drafting, namely Revit. Within these chapters, you will find the method required to produce working drawings to a national standard.

*The Professional Practice of Architectural Working Drawings*, 5th edition, has three divisions. Part I, “Professional Foundations,” consists of Chapters 1 through 6 and is designed to introduce such topics as Leadership

in Energy and Environmental Design (LEED), BIM, Revit, and green and sustainable architecture. The first third of the book thus investigates the field of architecture and takes a close look at how offices work.

Part II, “Document Evolution,” which includes Chapters 7 through 13, reflects the attitudes and concerns covered in Part I, while establishing a professional approach toward the national standards for architectural drawings. It also covers how to communicate the architect’s ideas into a series of dialogues among the architect, client, and contractor. Architectural words are defined as they are introduced in the text. An integration of chapters was developed to educate our pre-architectural pupil/readers to think three dimensionally, so that the process becomes a reality.

Part III, “Case Studies,” includes two new case studies completed in AutoCAD, intended to further demonstrate working drawings for both a one-story and a two-story wood-framed residence. Drawings are broken down from the fundamental stages to completion. Two additional chapters exemplify the drawings of more complex commercial buildings for study, but are developed with the use of BIM as implemented by Revit. Last is a commercial tenant improvement project, which exemplifies a typical build-out of an established architectural space, such as a storefront or high-rise building.

As educators, we recognize the need to create a document for the future challenge, giving our students a greater depth of understanding. If a prospective or new employee has good prior knowledge of the inner workings of architecture, an office will be able to teach technique in a short period of time. To that end, every chapter has been rewritten and reorganized to include a wealth of information on how drawings must be performed. All this is done with an eye toward how people learn. Education and architecture can and must be done in the same manner. It is imperative to perceive architecture holistically—as more than its parts—because the whole is indeed greater than the sum of its parts.

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Tony Micu, AIA, president of the South Bay Chapter of the AIA, for kick-starting our move toward BIM and Revit.

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P A R T



# Professional Foundations

**T**he information contained in Chapters 1 through 6 is intended to establish the fundamentals for those practicing in the field of architecture. These chapters will shape your understanding of an office, the practice, the stages, and the drawings of architecture. The concept of a good foundation applies to both

structures and individuals: without a solid foundation, failure is imminent. On this basis, the groundwork for architecture—the office and specific aspects of working drawings, an important component of construction documents—will be the backbone on which these chapters are founded.

- Chapter 1 Professional Foundations**
- Chapter 2 Standards and Techniques, Hand Drafting, Computer-Aided Drafting, and Metrification**
- Chapter 3 Human Concerns and Building Information Modeling (BIM)**
- Chapter 4 Sustainable/Green Architecture**
- Chapter 5 Construction Materials and Methods**
- Chapter 6 Initial Preparation Phase for Construction Documents**



chapter

# 1

## PROFESSIONAL FOUNDATIONS



## ■ THE PHYSICAL OFFICE

The physical plant of the architectural office has begun to take on a new look. The firm that once worked only in a local community now has a global reach. Where proximity once limited the opportunity for a client to access global talent, the computer, transportation, and communications technology allow for interviews based on architectural ability rather than proximity. It is no longer necessary to select an architect in one's immediate community because technology allows for virtual meetings around the globe.

It is not one firm but many that may construct drawings in a collaborative effort based on the ebb and flow of the size of the project. The result is that any firm of any size can join another to achieve an assigned task. Today, *network* does more than just describe a system of communication; it also describes the architect's role. An individual may work on a drawing halfway around the world, while at the project location it is the middle of the night. **Redlines**, or corrected drawings, can be marked up electronically and dropped in cloud servers for the next work shift, resulting in two times the production in the normal time. An architecture firm that specializes in design can partner with another firm that specializes in construction documents and utilize the strengths of each firm.

Architecture is a small crafts industry in which most offices employ one to four people. A home office may also be part of the office structure. A single drafter may be hired by two or more firms, in which case the office becomes a docking station for electronic project information, such as construction documents. Because digital images can be rapidly moved electronically, one can send documents across the world instantly. In the traditional architectural firm, an architect in a firm leads the project and distributes the work among the staff within the firm. When a workload jam arises, the architect may hire a subcontractor to aid in development of the required drawings.

## ■ OFFICE STRUCTURE

The way in which an architectural firm is structured and the office practices it employs depend on the magnitude and type of its projects, the number of personnel, and the philosophies the architects hold with regard to office practice procedures. Normally, the architect or architects are the owners and/or principals of the practice.

The architectural firm can be established as a sole proprietorship, partnership, or several options of corporations. When first establishing a firm, the principal of the firm must determine how to operate the business of architecture. The simplest of these is a **sole proprietorship**. This is not an ideal system for a large firm, but it may be ideal for a small firm that has a single owner that

will file the income as part of the personal income tax. This does not preclude the firm from hiring employees but it does limit the ability to have partners and does not easily separate personal assets from company assets. A **partnership** is where two or more people share the ownership of the company. These partners do not have to own equal shares of the company, and they share the profits based on the percentage of the ownership in the firm. Liability is similar to that of the sole proprietor but you must choose your partner well, as their good or bad decisions will directly affect your bottom line.

**Corporations** require at least two stockholders but could have hundreds of stockholders. While a corporation is the most complex system to establish due to laws that govern corporations, it's ideal for separation of personal/corporate assets. Within the laws that govern corporations, there are a variety of corporation types to choose from: S corporation, C corporation, limited liability partnership (LLP), and limited liability corporation (LLC).

Although a small firm will differ from a medium, large, or extra-large firm, many of the functions will be the same. In all firms, a licensed architect will oversee staff as a direct supervisor. In each firm, services such as **programming** (determining the objectives of the project), **space planning** (the layout of the furnishings and fixtures), feasibility studies, site analysis, coordination, scheduling, and architectural design will be provided according to the firm's contract with the client. As a firm's size increases, one major factor does change: that of documentation of directives and communications. Of course, it is imperative for a firm of any size to track its work and communications with clients. However, as the firm size increases, the documentation becomes critical; as larger project teams mobilize to perform tasks, any lack of documentation can result in reworking projects and significant loss of revenue.

In general, an architectural office can be separated into three main departments: the administration department, the design department, and the production department. The principal or principals oversee all three departments in addition to their other duties.

### Administration Department

The administration department handles all communications between the architectural firm and its clients on items such as contracts, fee schedules, billing for services, and similar matters. This department handles all secretarial duties, including all written correspondence, payment of operating costs, accounting procedures, paying salaries, marketing, and maintaining project records relating to individual project costs and procedures. This department may also handle **human resources (HR)** functions, including management of the firm's staff.

Under the purview of administration, many firms also include a marketing department. Tasks for this department

might include development and maintenance of a web site, creation and dissemination of publication materials, assembly of competition entries, and development of promotional materials. Marketing is used to focus a firm on a particular area of work and take advantage of opportunities that may arise for a specific project type that the firm prefers or in which it specializes.

## Design Department

The design department is normally headed by a principal architect and/or an associate architect. This person (or persons) meets with the client to determine the requirements of a project, the economics of the project, and the anticipated time frame for completing the construction documents. These initial concerns determine the program for the project. The head (or heads) of this department delegate various work phases of a project to other staff members. The number of staff members depends on the size of the practice and the magnitude of the projects. Staff members may be assigned to teams or groups in their area of expertise for specific projects. A team takes a project from the initial schematic design concept, through design development, to the completed construction drawings and specifications. These stages may include model building, renderings, coordination among all consulting engineers to meet their individual job requirements, job billing, and reproduction responsibilities. The leader of a project and of the design team staff is designated the **project architect**. A project architect's responsibilities are to develop a "game plan" for a specific project, which will include:

1. Design studies, philosophy, and concept
2. Initial structural considerations
3. Exterior and interior materials
4. Municipality and building code requirements
5. Architectural committee reviews
6. Building equipment requirements, **Leadership in Energy and Environmental Design (LEED)**
7. Manufacturing resources
8. Selection of required consultants (soils/geology, structural, mechanical, etc.)
9. Planned man-hours, time sheets, and billing dates
10. Office standards, such as symbols, wall delineations, and other graphic depictions

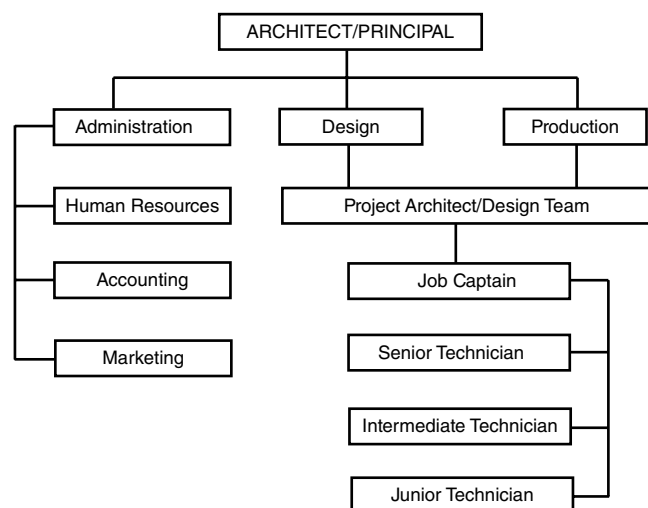
## Production Department

The production department, under the supervision of a project architect, prepares all the phases for a set of completed construction drawings. Working drawings may be produced by a senior drafter, intermediate drafter, or junior drafter under the supervision of a licensed architect. These staff members and the project architect or job captain work as a team to make the transition

from the approved preliminary drawings to the completion and implementation of the working drawings. The transition from the approved preliminary drawings to the development of the working drawings is elaborated in Part II of this book. Other chapters provide step-by-step procedures on how different sections of the working drawings are developed: the site and grading plan, foundation plan, floor plan, building sections, exterior elevations, roof and framing plans, interior elevations, architectural details, and schedules. During the process and completion of the various sections, the project architect and/or job captain constantly reviews the drawings for clarity, accuracy, and craftsmanship of detailing, and ensures that the drawings reflect all required revisions. Drawings are either created with the use of a **computer-aided drafting (CAD)** system, **building information modeling (BIM)**, or drawn manually using conventional instruments. A suggested organizational chart for the practice of architecture is depicted in Figure 1.1.

## The Architect

An *architect* is an individual licensed by the state in which he or she practices architecture. An architect can be licensed in multiple states and practice from multiple offices. In most cases, the architect has a college education consisting of an undergraduate four- or five-year degree or a six- to seven-year graduate program at an accredited university. For a university to become accredited, the **National Architectural Accrediting Board (NAAB)** must certify that university for its merit in education. In addition to the formal education, a three-year **apprenticeship** or on-the-job training by skilled practitioners in the field is required. In some situations, an **internship** (experience in an architectural office during one's course of education) may also be counted toward



**Figure 1.1** Suggested office organizational chart.

the apprenticeship period. The **Architecture Registration Examination (ARE)**—testing that rivals the bar exam for lawyers in difficulty—must be taken after completion of one's education; the ARE is administered by the **National Council of Architectural Registration Boards (NCARB)**. Programs such as the **Intern Development Program (IDP)** are instrumental in aiding candidates for licensing, because they allow candidates to obtain experience in the diverse areas that are required to run and supervise an architectural firm. Once a license is obtained, the holder is required to pursue continuing education.

While it is possible to receive an architectural license without a formal education, it is very difficult and requires eight years of direct supervision from a licensed architect or a combination of architect, engineer, and contractor. On-the-job training is an important aspect

of education, and in conjunction with the IDP program and passing the ARE, one can be a licensed architect.

## ■ RESOURCE LIBRARY

To find and detail all the equipment that is required for a structure (plumbing, hardware, finishes, etc.), it is necessary to have access to the various manufacturing resources for specific products. The most widely used product information source is the Internet. Electronic access allows architects and engineers to survey the resources available and select the equipment that will best enable the function of a building. Such equipment may be available from a myriad of different manufacturers, and range from conveying systems to windows, doors,

### Applications Guide

## MasterFormat GROUPS, SUBGROUPS, AND DIVISIONS

### **PROCUREMENT AND CONTRACTING REQUIREMENTS GROUP**

Division 00 – Procurement and Contracting Requirements  
Introductory Information  
Procurement Requirements  
Contracting Requirements

### **SPECIFICATIONS GROUP**

#### **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, Plastics, and Composites  
Division 07 – Thermal and Moisture Protection  
Division 08 – Openings  
Division 09 – Finishes  
Division 10 – Specialties  
Division 11 – Equipment  
Division 12 – Furnishings  
Division 13 – Special Construction  
Division 14 – Conveying Equipment  
*Division 15 – Reserved for Future Expansion*  
*Division 16 – Reserved for Future Expansion*  
*Division 17 – Reserved for Future Expansion*  
*Division 18 – Reserved for Future Expansion*  
*Division 19 – Reserved for Future Expansion*

#### **FACILITY SERVICES SUBGROUP**

*Division 20 – Reserved for Future Expansion*  
Division 21 – Fire Suppression

Division 22 – Plumbing  
Division 23 – Heating, Ventilating, and Air-Conditioning (HVAC)

*Division 24 – Reserved for Future Expansion*

Division 25 – Integrated Automation

Division 26 – Electrical

Division 27 – Communications

Division 28 – Electronic Safety and Security

*Division 29 – Reserved for Future Expansion*

#### **SITE AND INFRASTRUCTURE SUBGROUP**

*Division 30 – Reserved for Future Expansion*

Division 31 – Earthwork

Division 32 – Exterior Improvements

Division 33 – Utilities

Division 34 – Transportation

Division 35 – Waterway and Marine Construction

*Division 36 – Reserved for Future Expansion*

*Division 37 – Reserved for Future Expansion*

*Division 38 – Reserved for Future Expansion*

*Division 39 – Reserved for Future Expansion*

#### **PROCESS EQUIPMENT SUBGROUP**

Division 40 – Process Integration

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 for Future Expansion*

Division 48 – Electrical Power Generation

*Division 49 – Reserved for Future Expansion*

**Figure 1.2** MasterFormat division numbers and titles. (The above excerpt is from *MasterFormat™ 2016 Update*, © 2016 The Construction Specifications Institute, Inc. (CSI) and is used under license from CSI. For more information, visit <http://www.csinet.org>, or contact CSI at 110 South Union Street, Suite 100, Alexandria, VA 22314.)

and the like. Samples can be included in a firm's in-house library. Most of the literature found in electronic form is based on the **MasterFormat**, an organizational system widely used in the construction industry. These particular systems use the major divisions shown in Figure 1.2.

A wealth of product information is available directly from manufacturers, in the form of brochures, pamphlets, catalogs, manuals, and hardbound books. Actual samples of their products may also be obtained. The information available may include:

1. Advantages of a particular product over others
2. How the system works or is assembled
3. Necessary engineering
4. Detailed drawings
5. Special design features
6. Colors, textures, and patterns
7. Safety tests
8. Dimensioning
9. Installation procedures

Adapt this information to your particular needs in your geographic location. Also, understand that a manufacturer's goal is to sell product, so verify from neutral sources that it will do what it states.

You are limited only by your ability to navigate through the vast sea of information available through the Internet and your ability to retrieve the information necessary to satisfy and enhance completion of the working drawings. Digital drawings can also be obtained, making it unnecessary to draw configurations for products such as window profiles, stair rails, and so on. As the process of BIM becomes more mainstream, perhaps one of the greatest advantages is the family of information provided by the manufacturer to promote its product. Always verify the accuracy and appropriateness of a detail before you adopt it as your own.

Retail sources such as major book publishers produce architectural reference books. Many art supply and drafting supply stores also carry reference materials. Public libraries may have a variety of professional reference materials, including books, journals, and trade magazines. Colleges and universities offering architecture courses usually have a wealth of architectural resource materials. An example of a highly technical resource is the *AIA Architectural Graphics Standards* published by John Wiley & Sons. This book is found in almost all architectural offices. In addition, the **American Institute of Architects (AIA)** publishes standards and guidelines for architects to utilize as well.

## ■ ARCHITECT/CLIENT RELATIONSHIP

### Working Relationship

The relationship between the architect and the client will vary. In general, the relationship for a specific building

project and the responsibilities and procedures necessary to accomplish the goals of the project will be initiated with the selection of the architect. After the architect is selected, the architect and the client enter into a contract, which defines the services to be performed and the responsibilities of the architect and the client. The client can be an individual, couple, team, or board of individuals that give direction and goals for the development of the project. Many states require architects to use a written contract when providing professional services.

The form of the agreement will vary with the size of the project and the scope of services that the architect will provide. As you can imagine, the larger and more complex tasks require more dialogue or terms to address legal issues. A good contract can provide clarity and remind all parties of the responsibilities that are shared to complete the goals that are required and define scope that is outside the contract that would be considered added scope for added costs.

After the contractual agreement is signed and a retainer fee is received, the architect reviews the building site and confers with the client to determine the goals of the building project. After establishing the project goals, there will be meetings with the governing agencies, such as the planning department, the building department, and architectural committees. The primary goal of the architectural team at this point is to initiate the preliminary planning and design phases.

Most architectural contracts and agreements include provisions for the architect and the consulting engineers to observe construction of the project during the various building stages. It is a standard practice for the architects to visit the site, determine if the construction is progressing correctly, and report their findings.

### Professional Organizations

Professional organizations can be an asset to the business performance and office functions of an architectural firm. The AIA is an example of a professional organization that will provide members with recommended documents, including client/architect contractual agreements, client/contractor agreements, and many others. The AIA also provides recommended guidelines relative to fee schedules and disbursements, construction documents, building specifications, and construction observation procedures and documentation.

Ethical procedures and office practice methods are recommended and defined as part of the many documents available from the AIA.

It is recommended that associate architects and employees at the various technical levels become involved with a professional organization for a number of reasons, but primarily to stay aware of current technical information and activities within the architectural profession. The AIA also offers programs and directions for

those in an internship phase of their careers. Student associate member programs available through the AIA provide an overall view of the architectural profession.

Other professional organizations for students of architecture can be found through students' colleges and universities.

### Schematic Design

The next step in the architect/client relationship is the architect's presentation of the **schematic design (SD)** for the project. In this phase, an architect consults with the client/owner to determine the project goals and

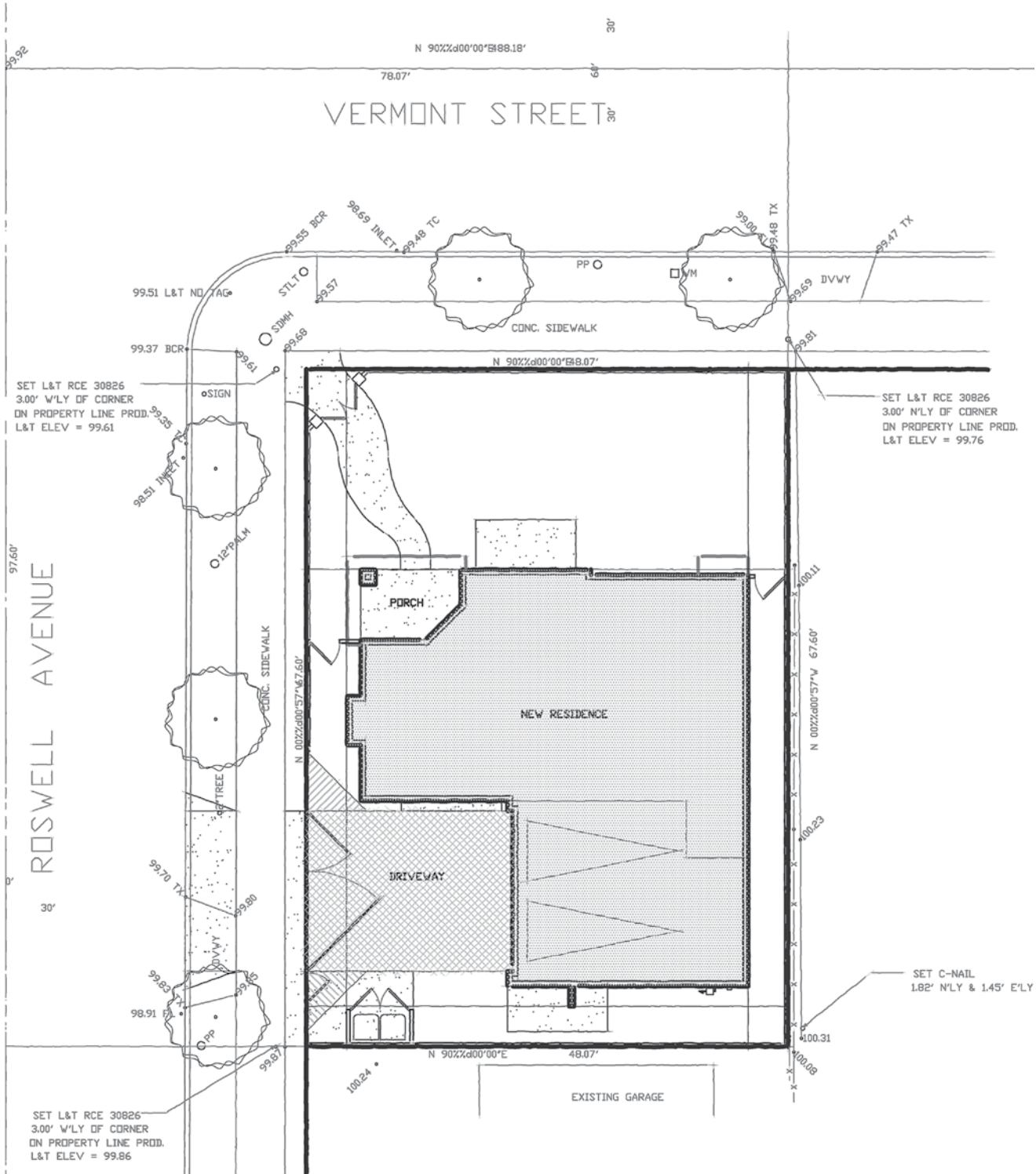


Figure 1.3 Schematic site design drawing. (Courtesy of Nichole Shweiri.)

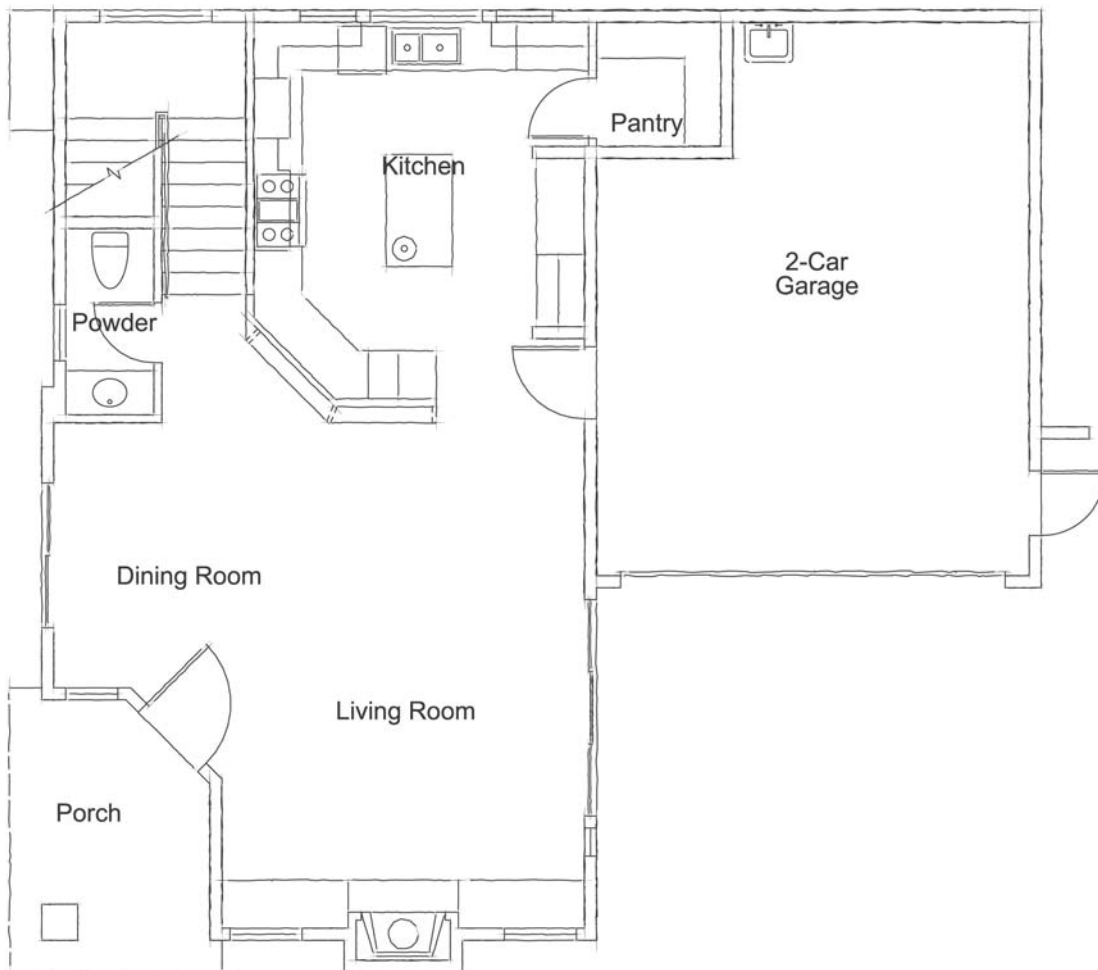


requirements, often called the program. The program, or architectural program, is used to establish the required functions of the project. I will typically include an estimated square footage of all the areas required in the project goals. In the SD phase, an architect develops study drawings, images, and documents that demonstrate the concepts of the design in scale that can best demonstrate the spatial relationships. Often, a conceptual site plan and floor plan of the building areas are reviewed for the building orientation and the preservation of existing landscaping elements such as trees, topography, and other site conditions. Figure 1.3 shows an example of a conceptual site and building plan. The client for this project desires to build a three-bedroom residence. The site, which is located in a beach community, is a small property. The lot is located on a corner where side and front-yard setbacks use most of the lot area, and the garage must be additionally set back to allow for a driveway with visibility.

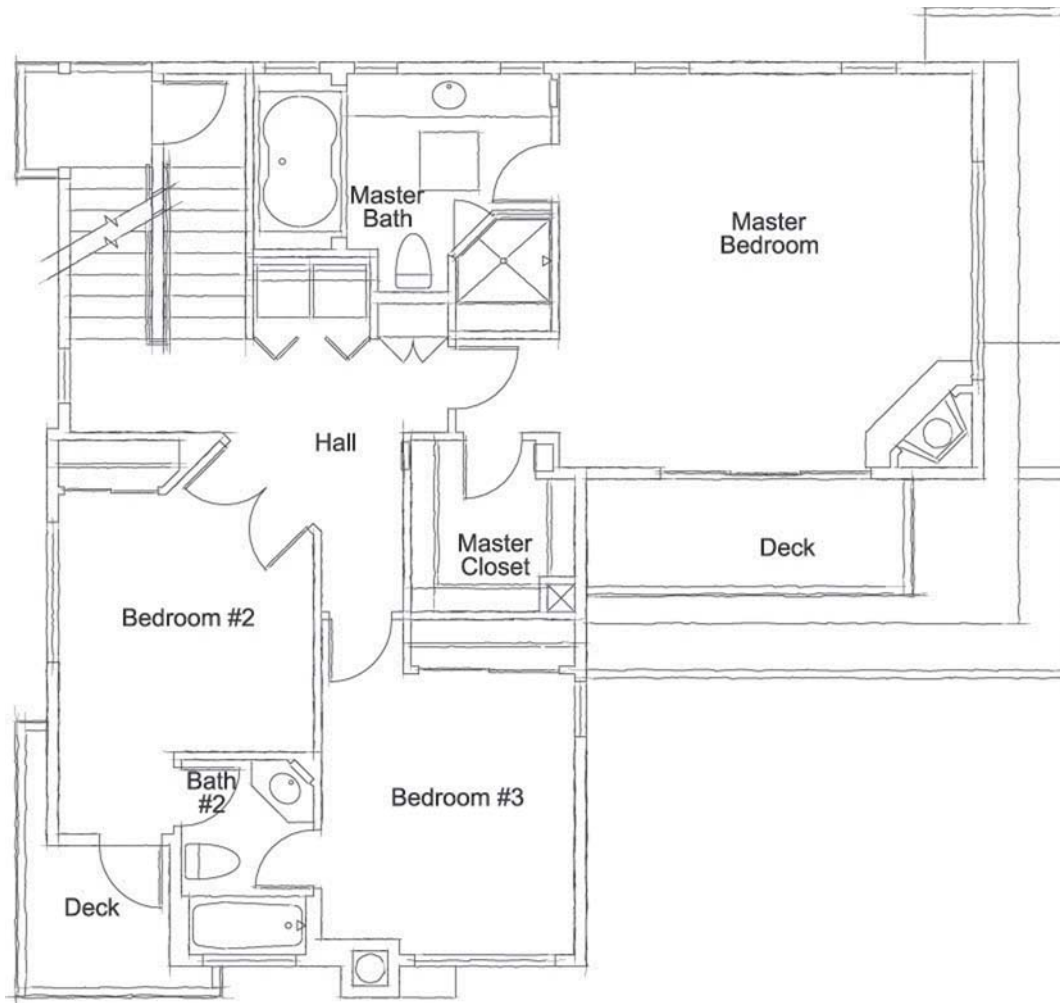
Schematic design also is the phase where research is done with respect to the jurisdictional departments. After the client's initial review of the planning and design for the project, some revisions and alterations

may be made to the design. In this case, the drawings are revised and presented again to the client for their approval. After the client approves the schematic design, the architect consults with and presents the schematic drawings to the various governing agencies, such as the planning department, for their review and comments. Any revisions and alterations that may be required by any of the agencies are executed and again reviewed by the client and approved. The schematic drawings are often used to estimate the initial construction costs, which are also submitted for client review and approval. Using BIM, it is possible to provide the client with a more accurate estimate of cost, because these programs incorporate the materials and methods of construction in the drafting process.

Wind direction, sun orientation, rainfall, flow of water on the site, and the most feasible automobile access to the site are considered (among other factors), and a schematic study is presented. From this initial schematic study, a preliminary floor plan is established, which shows the room orientations and their relationships to one another. Such a preliminary drawing is depicted in Figure 1.4. A second-floor-level preliminary plan is



**Figure 1.4** First-floor plan schematic design. (Courtesy of Nicole Shweiri.)



**Figure 1.5** Second-floor plan schematic design. (Courtesy of Nicole Shweiri.)

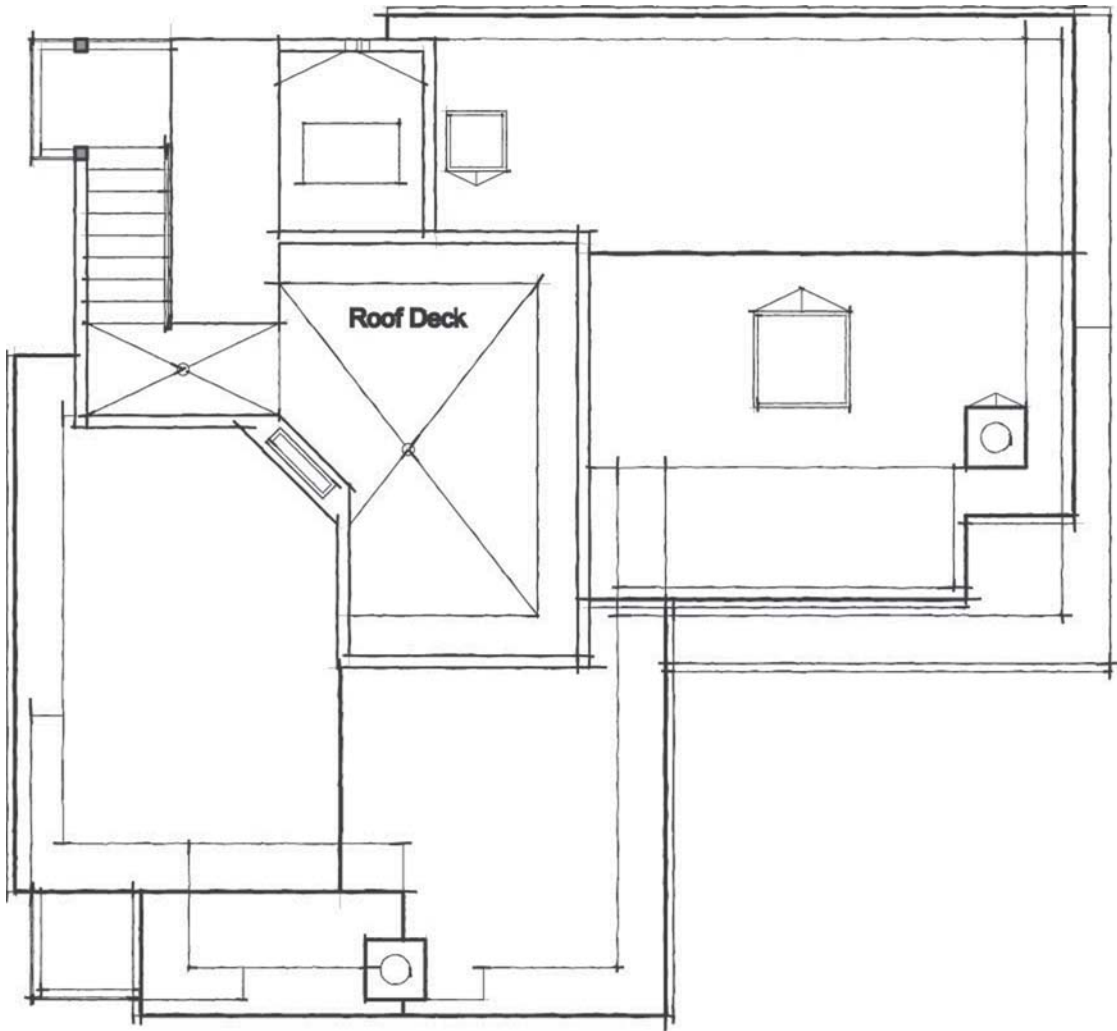
studied as it relates to the first-floor plan and the room orientation, as shown in Figure 1.5. Finally, a roof plan is designed to facilitate the use of a roof deck and roof garden; this preliminary study is illustrated in Figure 1.6. The studies of the exterior elevations evolved utilizing an asphalt shingle roof material, with a shallow pitched roof, and exterior walls of wood siding. After the client has approved the preliminary floor plans, the exterior elevations are presented to the client in preliminary form for approval and to the governmental agencies for their preliminary approvals. The north and west elevations are depicted in Figures 1.7 and 1.8. These preliminary drawings and designs are examples of the architect's studies that may be presented to a client for his or her approval prior to implementation of the design development and construction drawings.

### Design Development

After these numerous reviews of the schematic design, further development and refinement are required.

This improved-drawing design phase is termed **design development (DD)** and represents a more definite solution to the program and the intended building outcome. This phase takes the deliverables from the SD phase and develops them one step further. A primary area of refinement is materiality for the proposed project. During SD, a project may include all the rooms and a resolved floor-plan layout required for the client, but during DD the specific materials to be used in construction of the project will be determined. Small refinements would also be included in DD, such as where the windows and doors as well as fixtures in a kitchen would be located; this is in contrast to schematic design, in which you would just know where the kitchen is located relative to the adjacent rooms. As is the case for schematic design, after several reviews the architect will have the client sign off on the revised plans and budget for the project and move on to the next phase of work.

With a BIM program it is often difficult to determine when DD ends and the next phase begins, because BIM includes so much specific data (such as material



**Figure 1.6** Roof plan schematic design. (Courtesy of Nicole Shweiri.)



**Figure 1.7** North elevation schematic design. (Courtesy of Nicole Shweiri.)



**Figure 1.8** West elevation schematic design. (Courtesy of Nicole Shweiri.)

type and construction methods) that is front-loaded into the computer. In BIM, even at SD a 3-D drawing of the design has already been developed and can be viewed after a limited amount of data is entered.

### Materials and Specifications

There will be many conferences between the architect and the client during the design development phase to select and determine items such as exterior and interior wall finishes, ceiling finishes, flooring, plumbing fixtures, hardware design, type of masonry, roofing materials, and so on. During these conferences, the selections of building equipment and systems are also determined and reviewed. The equipment selection may include such items as types of windows and doors and the manufacturer, elevator type and manufacturer, mechanical system, electrical fixtures, and so on. A deliverable can include notes on the drawings or an actual packet of specifications assembled as a supplement to the drawings.

### Construction Documents

After the client and the various governing agencies involved approve the schematic designs and design development for a project, the architect's office initiates the construction drawing phase for the construction of the project. This phase includes drawings with great detail and would typically include specifications and construction details.

During the **construction document (CD)** phase, architects determine which consulting engineers are required on a specific project. The engineers may be employed

directly by the architect, or they may have their own private practices. These consultants may include soils and geological engineers, structural engineers, mechanical engineers, electrical engineers, and civil engineers. Other consultants may include landscape architects, interior designers, LEED consultants, and cost estimators. Periodic conferences with the client are recommended during this phase to attain approvals on the various phases of the construction drawings. These phases or stages may include lighting layout and electrical designs, cabinetry, reflected ceiling, and many other features for which client review and approval are needed.

Upon completion of the construction drawings and specifications, which are now termed *construction documents*, the architect and/or client may submit the CDs to financing institutions for building loans, to various construction firms for building cost proposals, and to governing agencies for their final approvals. Finally, the architectural firm will submit the CDs to the local planning and building department to obtain the required building permits.

### Bidding and Negotiating

Once the CDs have been developed, plans are put out to bid. Often accompanying the plans are the instructions to bidders, the bid form, bid documents, the owner-contractor contract agreement, bond requirements, and any added data that is required for completion of the bid process. For public projects, such as schools or state and federal buildings, an unlimited number of bidders can propose a price for completing the work. A public project is typically advertised and provides

the minimum qualifications required for the contractor to meet in order to be eligible to bid the construction project. On private projects, the clients may choose who may bid and how many bidders they would like for the job. Often, as many as four or five contractors will bid a job, allowing for a high, mid, and low bid and the opportunity to eliminate an unqualified bid or a bidder that has not met the bid submission deadline.

Negotiation of bids can occur for a project on which a specific price or timeline must be met. A single contractor may be asked to propose a budget and make revisions to replace expensive items or omit items from a project. The result of bid negotiations, ideally, is a modified contract document that will meet the budget and/or time requirements.

In this stage, it is the architect's responsibility to help the owner evaluate the bids and select a winning contractor. Any of the negotiation of scope and bid should be completed prior to the contract execution to minimize the confusion of scope. A letter of intent and a signed contract will be the trigger to allow construction to begin.

### Construction Administration

When the construction firm has been selected and construction has commenced, the architect and consulting engineers, according to their agreement in the contract, observe the various phases of construction. This phase in the architecture contract is termed **construction administration (CA)**. At this point, the architect's role may change to one that is more field active. These periodic observations generally correspond to the construction phases, such as field-visiting construction of the foundation, framing, and so forth. The services are determined and outlined in the owner-architect agreement or contract and can be a variety of levels of services. Following their observations, the architect and consulting engineers provide written reports to the client and contractor describing their observations, along with any recommendations or alterations they deem necessary for the success of the project. Performing site visits, making field revisions and clarifications, and responding to **requests for information (RFIs)** enhance opportunities for better design, budget, and schedule results. The primary role of the architect in this stage is to assist the contractor to build the project as specified in the CDs.

At the completion of the project, the architect and consultants make a final inspection of the construction of the building and prepare a **punch list**. This punch list, which is in written form, includes graphics indicating to the client and construction firm any revisions, reports, or alterations the architect or consultant deems pertinent and reasonable for a successful building project. After the construction firm makes the revisions, the architect and the consultants again inspect the project.

If acceptable, a final notice of approval is sent to the client and the construction firm.

## ■ BUILDING

### Building Codes

The purpose of building codes is to safeguard life, health, and the public welfare. Building codes are continually being revised to incorporate additional regulations based on tests or conditions caused by catastrophic events, such as hurricanes, earthquakes, and fires. In most cases, the governing building codes are similar in organization and context.

The requirements of various agencies and codes are of paramount influence in the design and detailing of today's structures. A great number of codes govern and regulate the many elements that are integrated into the construction of a building. The major codes that are used in the design and detailing of buildings are the building code, mechanical code, electrical code, fire code, energy code, and accessibility design criteria for compliance with the **Americans with Disabilities Act (ADA)**.

#### *Procedures for Use of Building Codes*

**STEP I.** *Building use and occupancy.* The first step is to classify the building use and to determine the occupancy group for the building. When the occupancy classification has been determined, the building is assigned a group designation letter, which determines the description of the occupancy and the group it falls under.

**STEP II.** *Fire-rated wall assemblies.* Most codes provide a chapter on acceptable fire-resistive standards for assemblies, so that the architect is able to select an assembly that satisfies his or her specific condition. For example, a one-hour fire-rated wall is constructed with 2" x 4" wood stud partition with 5/8" type "X" gypsum wallboard on both sides.

**STEP III.** *Building location on the site.* The location of the building on the site and the clearances to the property lines and other structures on the site determine the fire-resistant construction of the exterior walls. The openings are based on the distances from the property lines and other structures.

**STEP IV.** *Allowable floor areas.* The next step is to determine the proposed and allowable floor areas of the building based on the occupancy group, such as theater or assembly room, and the type of construction.

**STEP V.** *Height and the number of stories or floors in the building.* The architect computes the maximum height of the building and determines the number of stories and/or floors. The maximum number of stories and the height of the building are determined by the building occupancy and the type of construction.

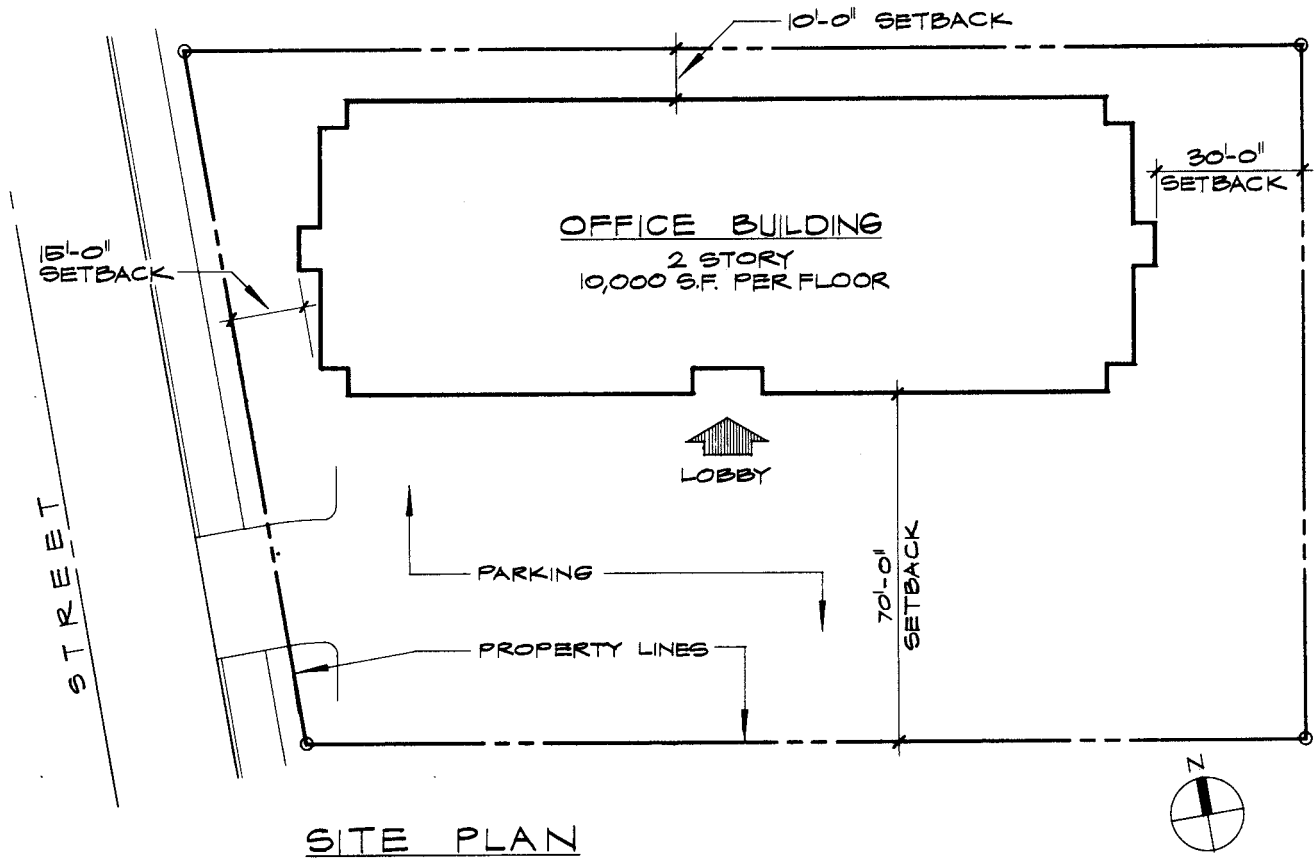


Figure 1.9 Site plan with setbacks illustrated.

**Code Influence on Building Design**

An example of code-related design requirements is provided by a site plan for a proposed two-story office building. The architect desires that all four sides of the building have windows. To satisfy this design factor, the minimum building setback from the property line will be a minimum 10 feet for openings in exterior walls. Figure 1.9 depicts the proposed site plan for the two-story office building, showing property line setbacks satisfying one design requirement.

As the design program is developed, it is helpful to provide code-required assemblies in graphic form as a visual means for reviewing what is required for the various elements of the office building. An example of such a graphic aid appears in Figure 1.10. Building codes specify the wall assemblies that meet the fire-resistive requirements for the various elements of the building type selected.

**Exit Requirements.** Another very important part of a building code is the chapter dealing with egress requirements. This chapter sets forth the number of required exits for a specific occupancy use, based on an occupant load factor. The occupant load will depend on

the use of the building. In the case of a two-story building that is designed for office use, the occupant load factor is 1 person per 100 square feet. To determine the number of exits required, the 100-square-foot occupant load factor is divided into the office floor area of 10,000 square feet. The resulting occupant factor of 100 exceeds the factor of 30, therefore requiring a minimum of two exits.

The next step in the design program is to plan the location of the required exits, required stairs, and an acceptable egress travel (the path to a required exit). Building

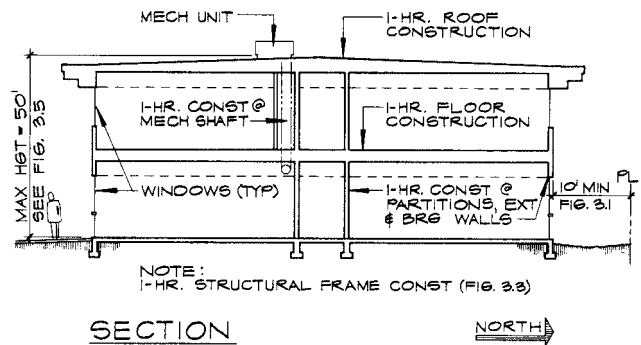


Figure 1.10 Graphic building section with fire-rated assembly.