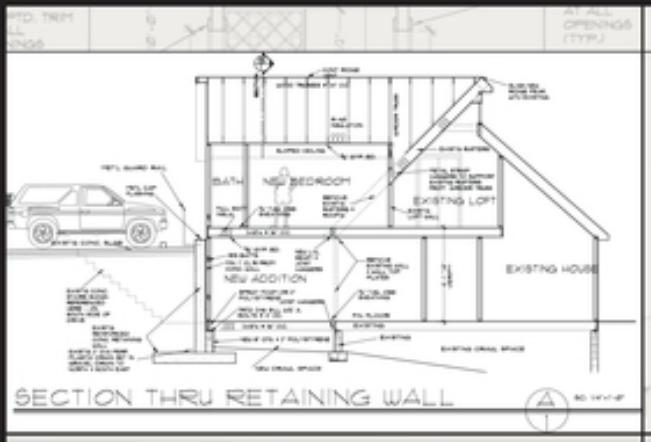
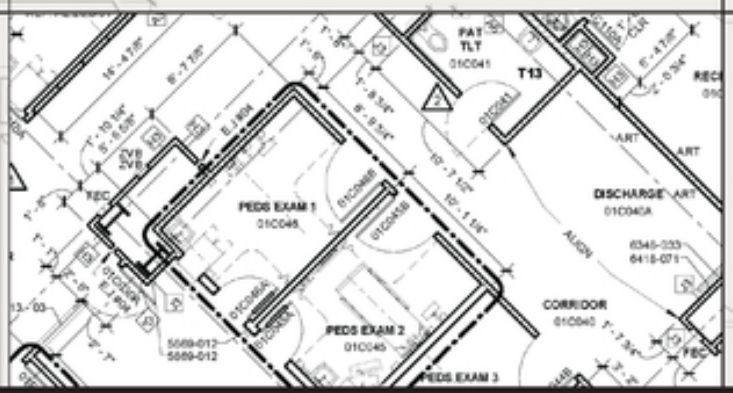


ROSEMARY KILMER AND W. OTIE KILMER

CONSTRUCTION DRAWINGS AND DETAILS FOR INTERIORS

FOURTH EDITION



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Construction Drawings and Details for Interiors

FOURTH EDITION

ROSEMARY KILMER AND W. OTIE KILMER

WILEY

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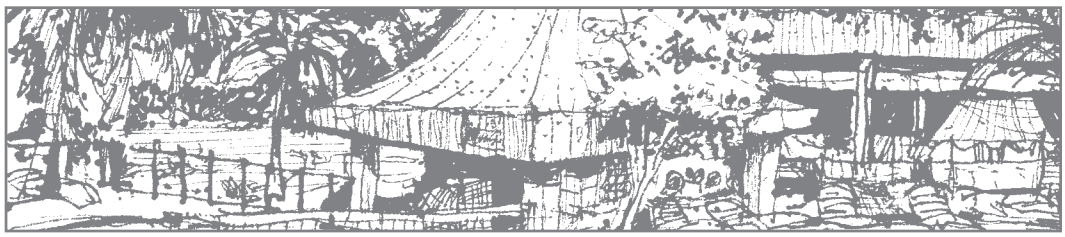

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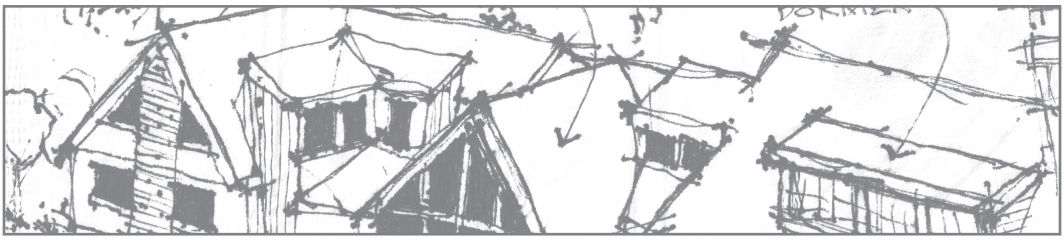


Preface

The fourth edition of this book expands upon the third edition, includes some new topics, and incorporates new images. The authors again wish to thank the many students, teachers, and professionals who used the former editions giving us valuable input as to what needed to be revised, expanded, or added.

When *Construction Drawings and Details for Interiors: Basic Skills* was first published over seventeen years ago, the intent was to provide a guide (handbook) for preparing construction drawings for the field of interior design. The book was designed for students in interior design programs as well as interns in offices that design interiors and are expected to produce construction drawings. At the time of the first edition, there were no books on the market that dealt with the process of preparing construction drawings specifically for interiors and all the information that needed to be conveyed, or that go in depth to explain how to organize this vast amount of information into a quality set of construction documents.

In this fourth edition of *Construction Drawings and Details for Interiors*, basic and advanced skills are covered. The entire process—from beginning drawing/drafting skills through design development, and finally construction documents—is presented. There are also several changes and additions in this fourth edition. Interior designers must be able to communicate with other professionals in the building industry and must understand how a building is constructed from the ground up. Today, interior designers are required to understand a vast amount of knowledge about construction assemblies, materials, finishes, lighting, mechanical and electrical systems, building codes, and structural systems. Therefore, we have updated this information throughout this addition where applicable.

Chapter 1 has been expanded under "Issues Affecting How Interior Designers Communicate" to include the pandemic of 2020, more building certification programs, and parametric design. Chapter 3 has been expanded to include a section on "Starting the Drawing" with a step-by-step method to basic techniques of hand drafting. Plus, a checklist has been added to this chapter.

A new section on Contract Administration has been added to Chapter 6 discussing the importance of record keeping and the various activities and forms involved during the construction process. Documents that interiors designers should be aware of include requests for information (RFI), change orders (CO), submittal review, field reports, and punch lists. Examples of these forms have been included, as well as an example of a revised plan with a highlighted by a revision "cloud".

Laser and sonic measuring devices for field measuring was added in chapter 7 and a new illustration of doors as defined by operation was added to chapter 8. Numerous updates and illustrations were added to all chapters including current usage of light emitting diodes (LED) lamps to chapter 17.

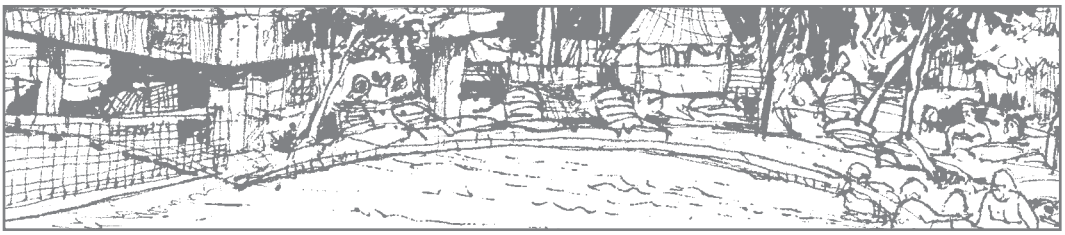
The checklists at the end of each chapter have been expanded in scope. Forty-nine new illustrations have been added or updated to more clearly show the specifics discussed in the writings.

The glossary has been expanded to include more terms used in the building industry. Appendices have been updated to match current standards related to the preparation of construction drawings for interiors. Appendix C "Trigonometric Functions: Sines and Cosines of Angles," has again been included to assist with some lighting calculations as is explained in Chapter 17.

Another area that has been expanded to provide good resources for instructors is the *Instructor's Guide*, which is available through a dedicated Wiley website. It includes a summary of each chapter with *Learning Outcomes* and *Key Terms* to help in the organization and teaching a course. Sample exam questions and answers for each chapter are provided to encourage critical thinking and discussion. These sample questions along with some suggested activities can assist instructors in evaluating students' comprehension of the material presented. PowerPoint presentations are included for each chapter to help instructors' present visual information for teaching and engaging students for better understanding.

Another feature is a dedicated website for students (available on the Wiley website). It includes flash-cards and interactive self-test questions, as well as photographs and case study construction drawings for both residential and commercial interior projects. This student website will provide students with additional resources for understanding the design and construction industries.

In conclusion, we are committed to the interior design profession and continue to be involved in the future of designing interiors and look forward to any comments or input on this edition and for future editions.



Acknowledgments

Writing the fourth edition of this book has been a satisfying and learning experience. It has taken the knowledge and skills of several people to bring this fourth edition to print. The authors wish to express their sincere thanks to the following people who helped in the development of new material, revision of existing information, and preparation of this edition.

First, we would like to thank our former students, who showed their enthusiasm to learn more and more each year, which challenged us to keep abreast of the issues and best practice standards facing the interior design profession.

Special appreciation is expressed to the professionals and organizations that provided us with illustrations and permissions to use their materials to make this edition a strong visual experience. Thanks to Luke Kwan of IA Interior Architects for providing us with his professional experience and several new illustrations for this edition. Again, we are thankful to KJG Architecture, Inc.; Maregatti Interiors; HKS, Inc.; Perkins+Will; and Chapman Sisson Architects for supplying professional examples for this book. Every effort has been made to correctly supply the proper credit information.

We are grateful to a number of interior design educators for their helpful suggestions as to what needed to be revised or included in this edition to keep this book as a strong complement for the teaching of Construction Drawings and Details for Interiors.

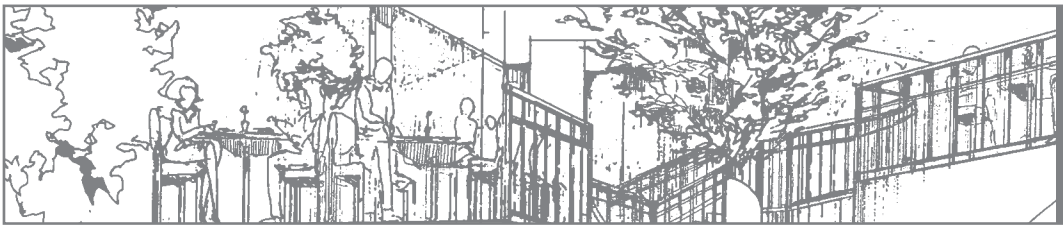
We are very grateful to the dedicated staff at John Wiley & Sons for their guidance, assistance, and dedication to this edition. We are particularly indebted to Amy Odum, senior production editor, for guiding us through the editing and production phase of this project. We are also grateful to (we need Wiley names and titles here, please) and to the rest of the editorial, production, and design staff at John Wiley & Sons, who helped turn the manuscript into a finished publication.

A special thanks to Lisa VanZee and Courtney Johnston, our daughters, as well as Jeff Johnston, our son-in-law, who again we rely on for their professional experience as to contemporary standards and best practices in the architecture and interior design professions.

Most of all, we would again like to acknowledge each other's support (Otie and Rosemary) as we continue to update these textbook editions for the students, teachers, and professionals involved in interior design.

PART 1

Drawing Communication, Equipment, Fundamentals, and Classification Systems



1

Design as Communication

Ideas and plans are formed in the interior designer's mind, but to be transformed into reality, they must be communicated to others. Although a designer might have a great idea, it must be effectively communicated, or it will remain just an idea and never move beyond conception. Interior designers and other professionals in the building industry use drawings as the primary means of developing and sharing their ideas. Interior designers and architects do a lot of sketching and drawing. They develop their skills in freehand drawing by sketching existing objects and spaces in the environment (Figure 1.1).

These same skills of observation and sketching are then used in ideation and visualizing designs for new spaces and objects (Figures 1.2 and 1.3).

This process of brain, eye, and hand coordination is an intrinsic part of design. Architectural drawings can be grouped into three basic types: drawing as idea generation, drawing as a design and presentation medium, and drawing as a guide for the construction process. There are distinct differences between each of these types, yet they all contain some common drawing tools, techniques, standards, and graphic language.

Design communication is also influenced by issues that regulate the building industry, such as building codes that protect the health, safety, and welfare of the public. Currently, other issues, such as universal design, user participation, sustainability and green building certification programs, globalization, digital technology and building information modeling (BIM), affect the way designers communicate their ideas.

DRAWING FOR IDEA GENERATION

Idea generation assists the designer in working through and visualizing the solution to a problem. Designers use many different types of drawings to generate and bring to reality their creative ideas.

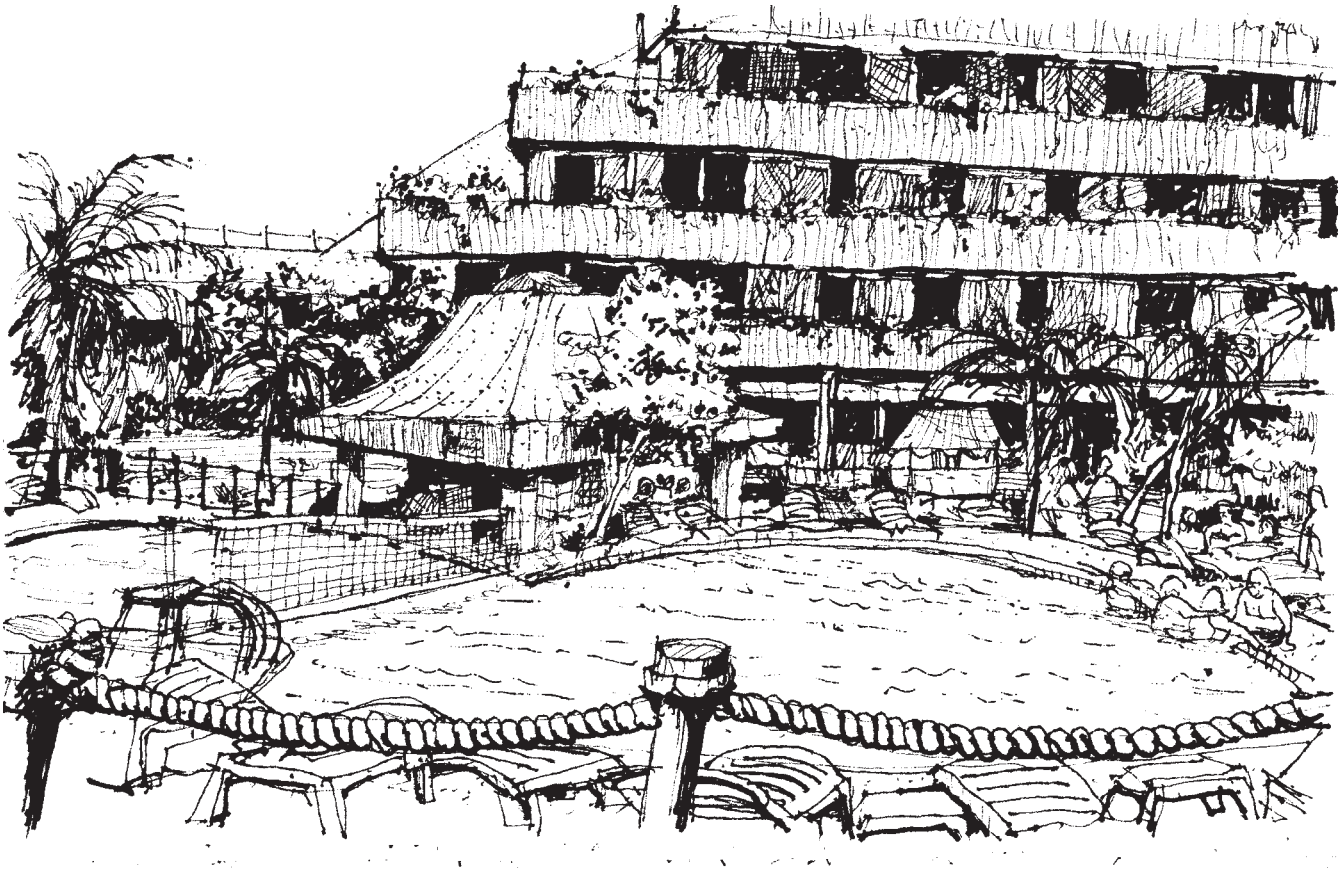


FIGURE 1.1. Sketching existing objects and spaces help designers develop their freehand drawing skills.

These drawings can be in the form of quick freehand sketches illustrating different kinds of views (Figure 1.4).

Many times, these types of drawings are not shown to clients, but are used solely to help designers shape their ideas into a visual form. The drawings are not intended to be the final solution to an idea, but rather to allow the designer to explore alternatives or refine an idea. They also help to record designers' two- and three-dimensional thinking. These concept sketches and drawings are part of a sequence of design steps referred to as the *design process* (Figure 1.5). See Chapter 5 for more detailed information on "Concept Development and the Design Process."

DRAWING AS DESIGN AND PRESENTATION MEDIA

Once a designer has developed an idea to a point that visual communication is needed to show it to the client or others, new drawings must be created for use as presentation media. These drawings depict the parameters of an idea in more detail yet are not totally worked out to a point that they can serve as an accurate construction guide. Design drawings can range from pictorial renderings of an idea (Figure 1.6) to more detailed plan views of a building's interiors (Figure 1.7). In the first example, a rendering is often done as a perspective view (Chapter 4), which resembles a photograph.

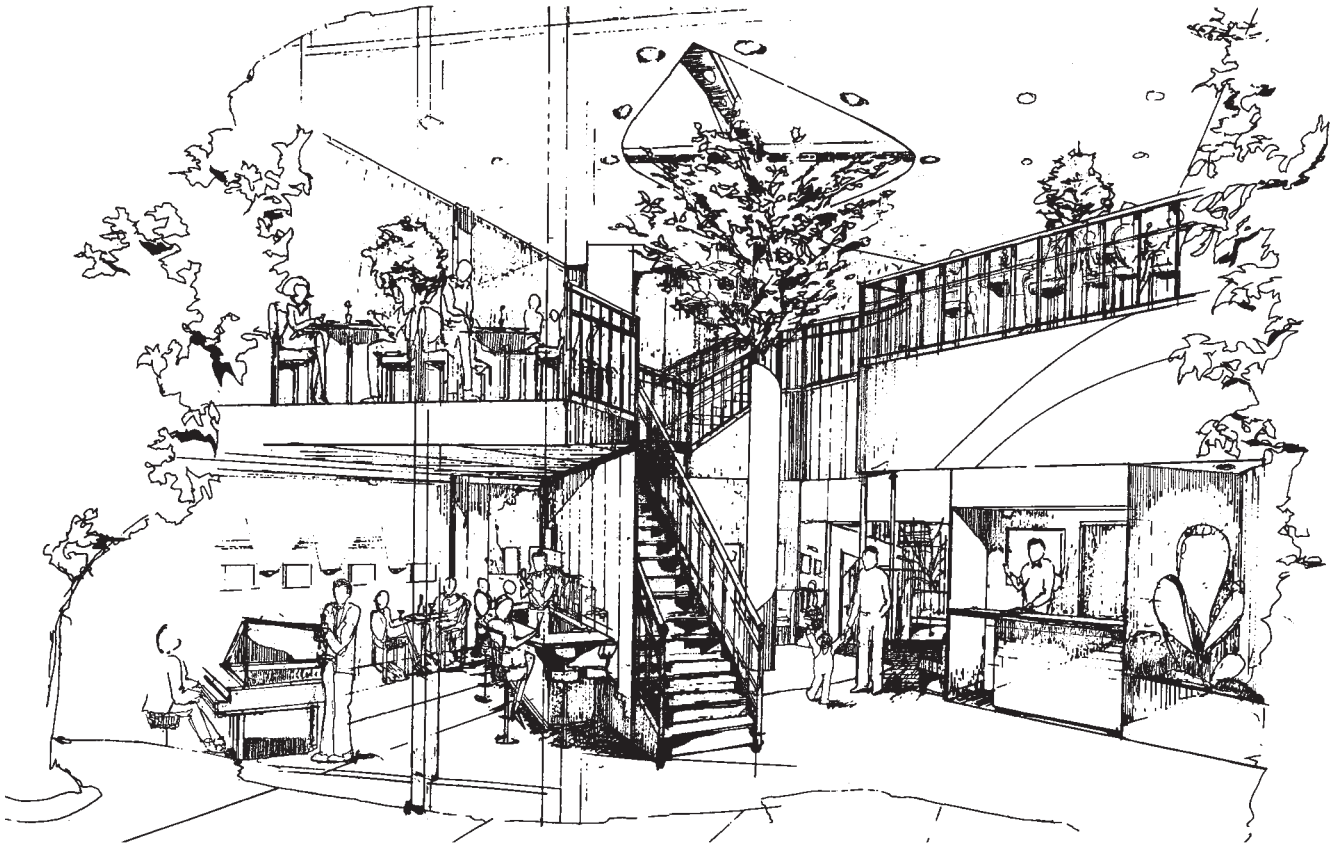


FIGURE 1.2. Designers can use their freehand drawing skills to visualize and sketch new spaces and objects.

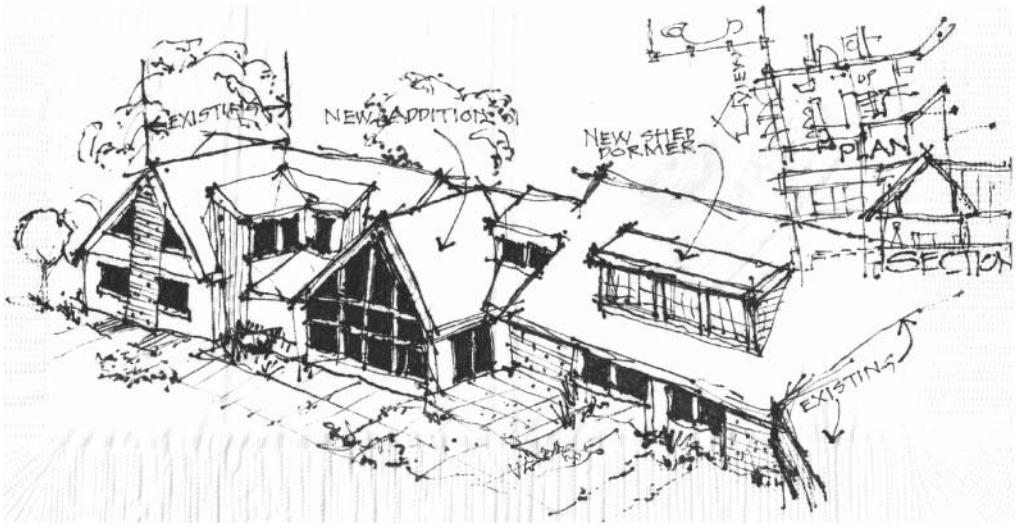


FIGURE 1.3. An example of a sketch for an addition to a residence that was drawn on a napkin in front of the client.

The receding lines of an object are purposely drawn to a distant vanishing point—similar to the effect of railroad tracks that appear to touch at the horizon. Design drawings are also done using techniques other than perspectives, such as the isometric shown in Figure 1.8. Different types of drawings are discussed further in Chapter 4.

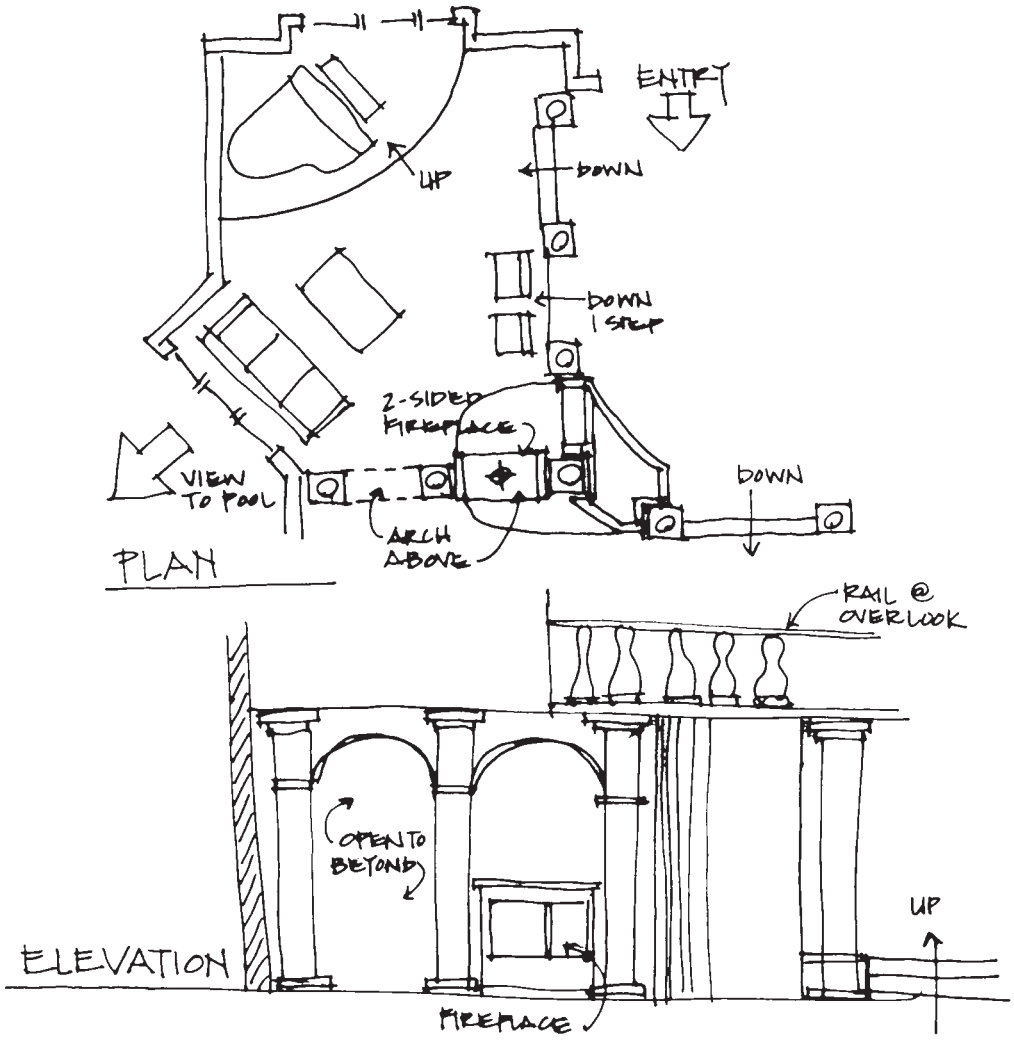


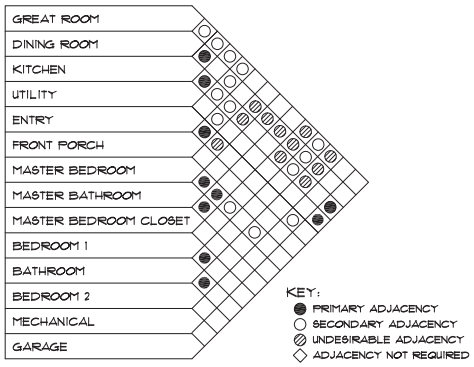
FIGURE 1.4. Quick freehand sketches, such as this floor plan and elevation, can be used to bring designers' creative ideas to reality. Courtesy of Courtney Johnston.

DRAWING AS A GUIDE FOR CONSTRUCTION

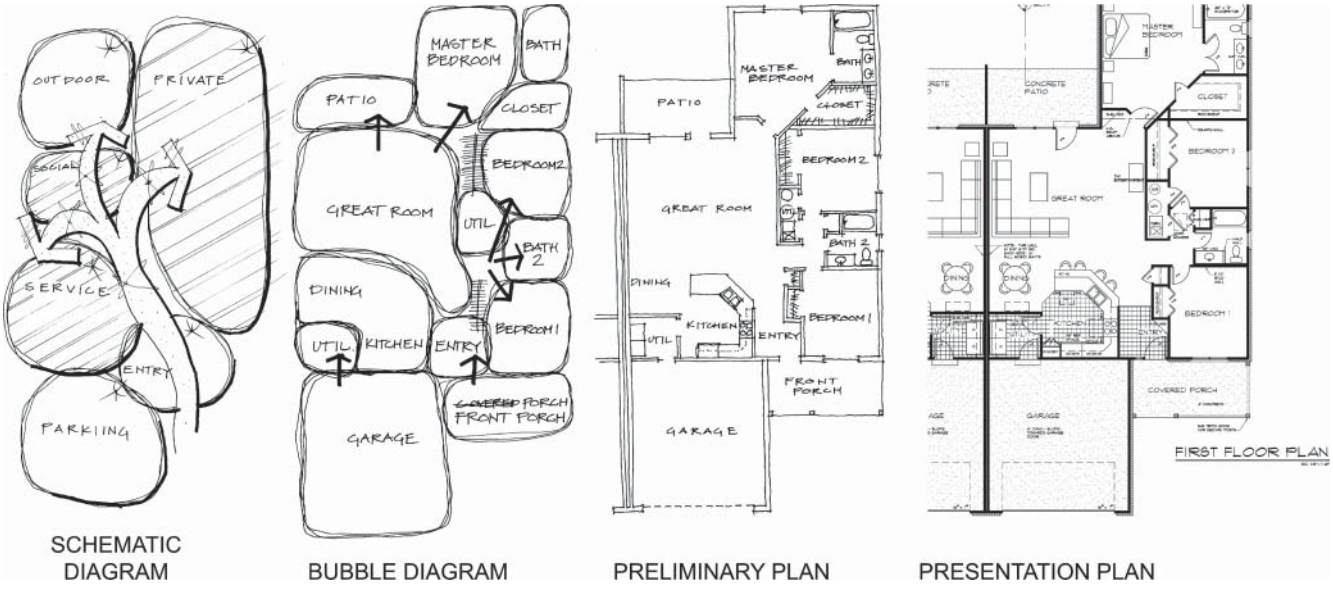
Drawings serve as the prime means of communication for constructing buildings, interior spaces, cabinets, furniture, and other objects. Construction drawings are scaled, detailed, and accurate representations of how an object looks and how it is constructed as well as the materials used (Figure 1.9). The drawings follow established architectural graphic conventions to indicate sizes, material, and related information that is needed to bring the objects or spaces into reality (Figure 1.10). The builder needs clear, concise drawings that are directly related to the different views of an object, such as plans, elevations, sections (Figure 1.11), and other drawing types that are discussed in later chapters.

ISSUES AFFECTING HOW INTERIOR DESIGNERS COMMUNICATE

Interior design is a constantly changing discipline that is affected by societal, environmental, and technological changes. The major impact on how interior designers communicate has been the pandemic of 2020. This pandemic has affected how and where designers work as well as how they physically interact with colleagues, clients, manufacturers, suppliers, builders, and other trades. This has led them to rely more on technology to design and communicate with others. The pandemic has also placed greater emphasis on hygienic solutions, such as "touch-free" products.



ADJACENCY MATRIX



SCHEMATIC DIAGRAM | BUBBLE DIAGRAM | PRELIMINARY PLAN | PRESENTATION PLAN

FIGURE 1.5. Adjacency matrices, concept sketches, and drawings are part of a sequence of design steps known as the design process.

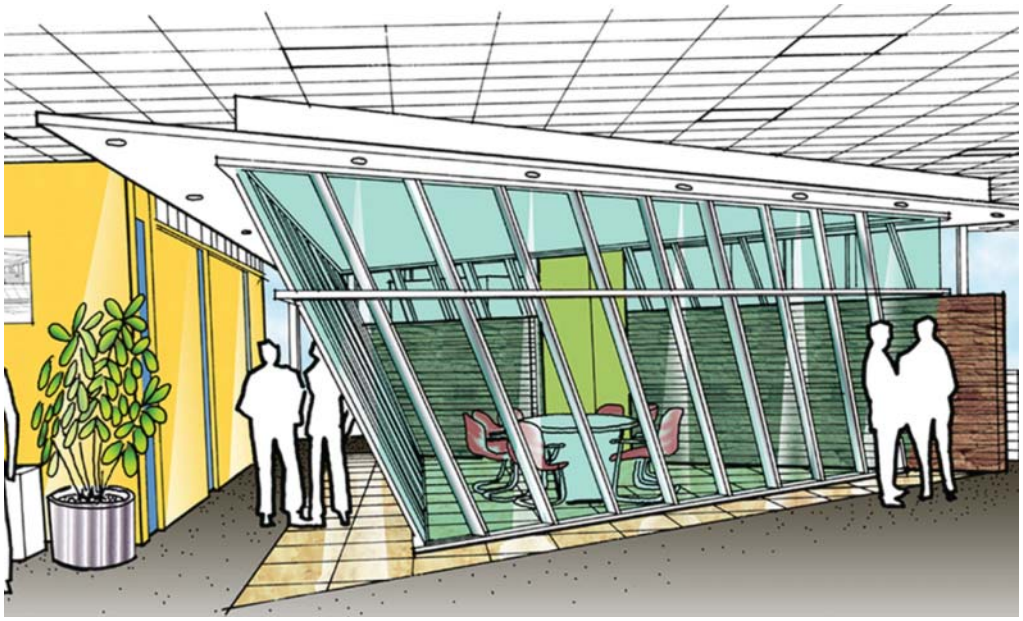


FIGURE 1.6. Design drawings, such as this pictorial rendering, show ideas in more detail.

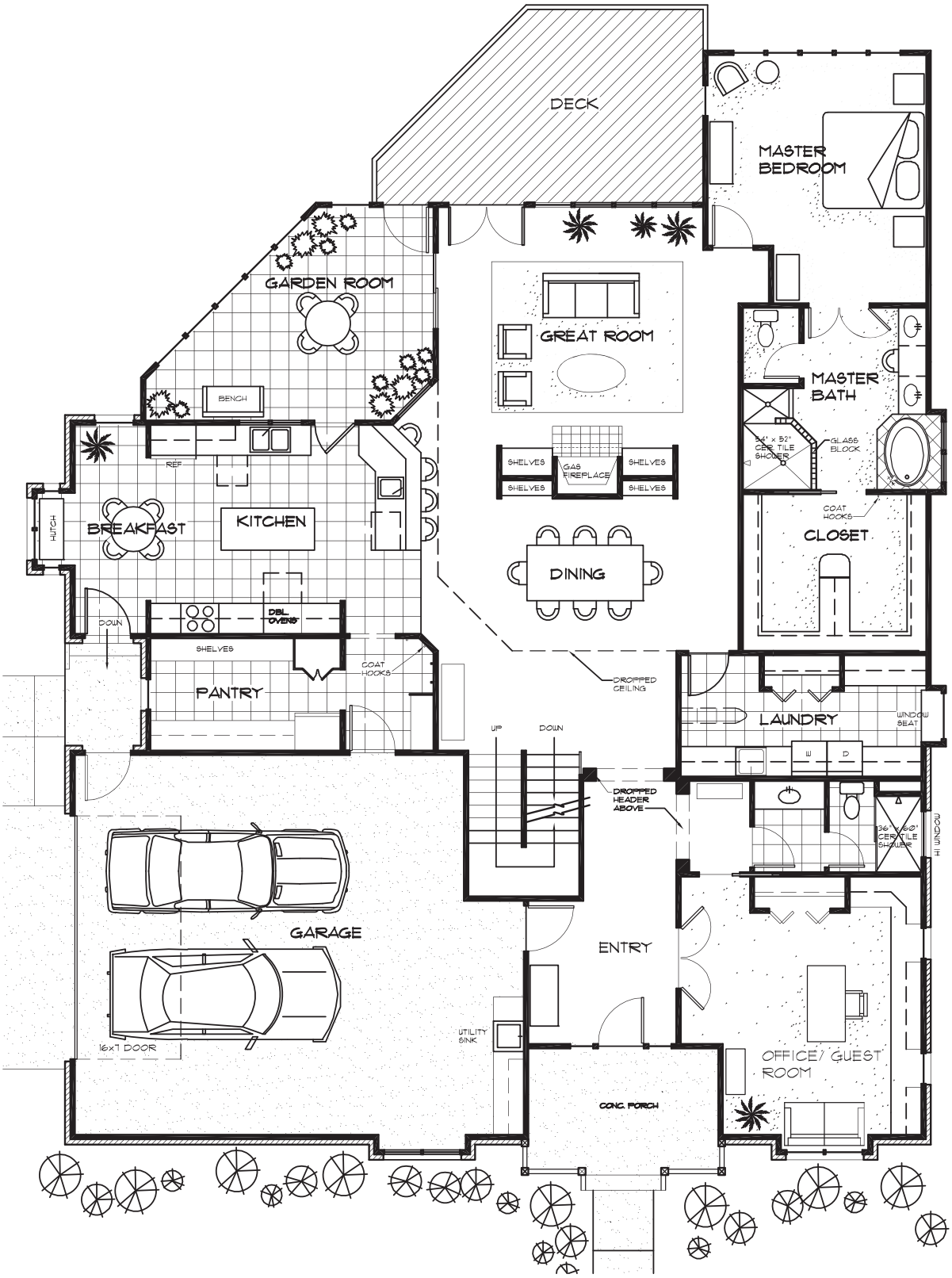


FIGURE 1.7. Design drawings can also show more detail in the form of plan views of a building.

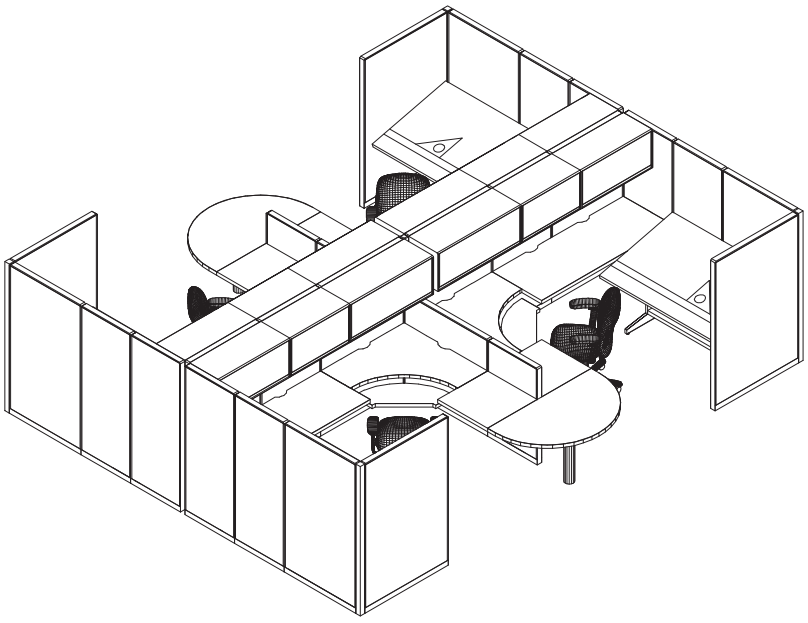


FIGURE 1.8. Design drawings can be done in a variety of techniques, such as this isometric drawing.

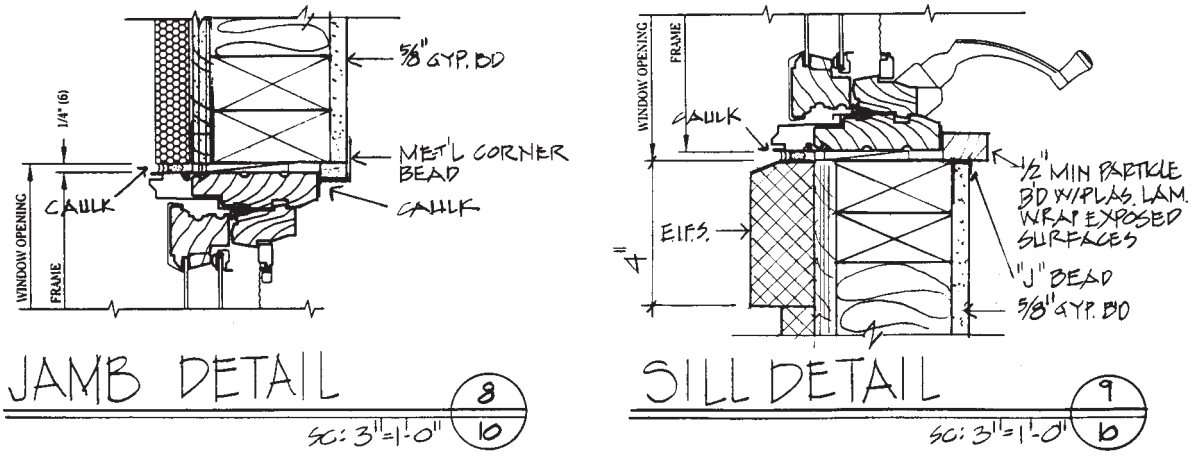


FIGURE 1.9. Drawings used to communicate how something should be constructed are scaled, detailed, and more accurate; they also show materials to be used.

Other issues affecting how interior designers communicate are influenced by universal design concepts, user participation, globalization, sustainability, and digital technology as they apply to design practice within the building industry.

Universal Design

Universal design is a worldwide belief that encompasses the design of environments, objects, and communication with the intent of serving the widest range of users. Universal design should not be used interchangeably with accessible design, which specifically focuses on people with disabilities and their right of access to entities. Universal design is more than providing minimal compliance with set accessibility guidelines and requirements. Universal design integrates accessible features into the design of the building, interiors, and objects for all people of all abilities and ages—including children, the elderly, and those with special needs. It attempts to address usability issues of spaces and equipment as opposed to setting standards and minimum requirements. Figure 1.12 illustrates an example of the international symbol for accessibility regardless of the user's abilities.

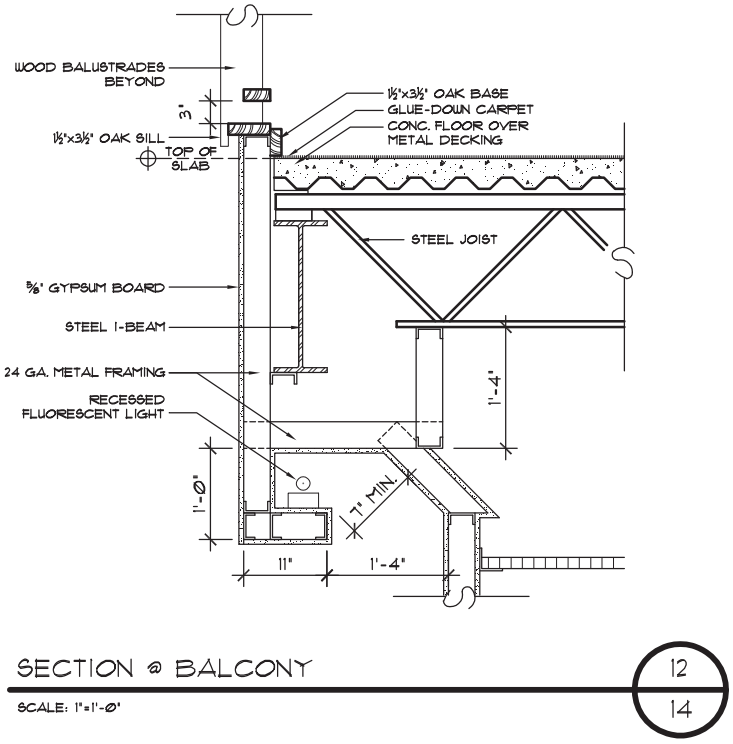


FIGURE 1.10. Designers use graphic conventions to indicate sizes, material, and related information needed to turn ideas for objects or spaces into reality.

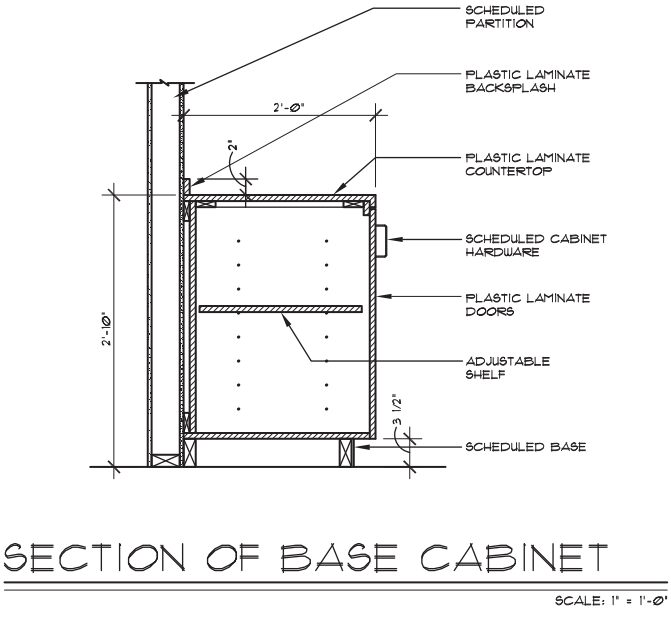


FIGURE 1.11. Clear, concise drawings of an object, such as this section, help a builder to construct the object as the designer envisioned.

The Center for Universal Design at North Carolina State University, in collaboration with a consortium of universal design researchers and practitioners, developed seven principles of universal design that were copyrighted in 1997. Funding for the project was provided by the US Department of Education's National Institute on Disability and Rehabilitation Research. These principles are useful in guiding designers in the creation of environments that are accessible to all people, whether they have a disability. Good examples of universal design are almost invisible, as they are so well blended into the design that they seem commonplace.

FIGURE 1.12. This is the internationally recognized symbol for compliance for wheelchair access.

Seven Principles of Universal Design

PRINCIPLE ONE: Equitable Use

The design is useful and marketable to people with diverse abilities.

Guidelines

- Provide the same means of use for all users: identical whenever possible; equivalent when not.
- Avoid segregating or stigmatizing any users.
- Provisions for privacy, security, and safety should be equally available to all users.
- Make the design appealing to all users.

PRINCIPLE TWO: Flexibility in Use

The design accommodates a wide range of individual preferences and abilities.

Guidelines

- Provide choice in methods of use.
- Accommodate right- or left-handed access and use.
- Facilitate the user's accuracy and precision.
- Provide adaptability to the user's pace.

PRINCIPLE THREE: Simple and Intuitive

Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

Guidelines

- Eliminate unnecessary complexity.
- Be consistent with user expectations and intuition.
- Accommodate a wide range of literacy and language skills.
- Arrange information consistent with its importance.
- Provide effective prompting and feedback during and after task completion.

PRINCIPLE FOUR: Perceptible Information

The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

Guidelines

- Use different modes (pictorial, verbal, tactile) for redundant presentation of essential information.
- Provide adequate contrast between essential information and its surroundings.

- Maximize "legibility" of essential information.
- Differentiate elements in ways that can be described (i.e., make it easy to give instructions or directions).
- Provide compatibility with a variety of techniques or devices used by people with sensory limitations.

PRINCIPLE FIVE: Tolerance for Error

The design minimizes hazards and the adverse consequences of accidental or unintended actions.

Guidelines

- Arrange elements to minimize hazards and errors: most used elements; most accessible; hazardous elements eliminated, isolated, or shielded.
- Provide warnings of hazards and errors.
- Provide fail-safe features.
- Discourage unconscious action in tasks that require vigilance.

PRINCIPLE SIX: Low Physical Effort

The design can be used efficiently and comfortably and with a minimum of fatigue.

Guidelines

- Allow user to maintain a neutral body position.
- Use reasonable operating forces.
- Minimize repetitive actions.
- Minimize sustained physical effort.

PRINCIPLE SEVEN: Size and Space for Approach and Use

Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility.

Guidelines

- Provide a clear line of sight to important elements for any seated or standing user.
- Make reach to all components comfortable for any seated or standing user.
- Accommodate variations in hand and grip size.
- Provide adequate space for the use of assistive devices or personal assistance.

User Participation

User participation is an important and integral part of the design process as designers seek to be more responsive to their clients' needs and wants in their interior environments. User participation solicits direct input from the client(s) or users during the design phase of a project. This process is a design tool that makes the client/user an integral part and have a voice in the shaping of their renovated or new building project.

Designers seek user participation by communication directly with the client/users in a face-to-face conference during which the designer can simulate and sketch ideas immediately or use digital devices to compile the ideas in real time. Consumers and clients have become more aware of their environments and products. In turn, designers will continue to search for improved user

participation as they create viable and personally satisfying solutions for the interior environment. Personal digital devices and computer sharing have made the input, collection, organization, and dissemination of client interaction more available and will continue to evolve as a valuable design tool.

Sustainability and Green Certification Programs

The built environment has a profound impact on our natural environment, economy, health, and productivity. Because of this impact, the design, creation, and maintenance of the built environment presents both challenges and opportunities for design professionals. Sustainable design and green design have become common terminology in the design field and involve using methods and products that cause the lowest possible impact upon the ability of the natural environment to maintain its natural balance. Interior designers must practice in an environmentally responsible manner and must advance their knowledge and application of sustainable design in order to advance sustainable practice. One way this can be accomplished is through an understanding of Green Building certification programs. There are many different certification programs to choose from. The following are just a few of the major rating systems currently available to building and interior designers. More detailed information on each of these rating systems can be found on the internet.

LEED

The most recognized sustainable building certification is LEED (Leadership in Energy and Environmental Design) and the Green Building Rating System™, which was developed by the US Green Building Council (Figure 1.13). This system encourages and accelerates global adoption of sustainable green building and development practices through the creation and implementation of universally understood and accepted tools and performance criteria. LEED promotes a holistic building approach to sustainability by recognizing performance in key areas of human and environmental health. LEED helps buildings to focus on efficiency and leadership to deliver the triple-bottom-line returns of people, planet, and profit.

FIGURE 1.13. This is the logo for the US Green Building Council, which developed the LEED rating systems.

LEED v4.1 is the most recent standard for green building design, construction, operations, and performance. LEED v4.1 has eight separate certification programs based on the nature of the project, including ones for new buildings, new interiors, existing buildings and spaces, neighborhood development, cities and communities, residential, recertification, and retail.

These rating systems rate or give credits for standards in eight key areas of human health and environmental sustainability that include location and transportation, sustainable site development, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, innovations, and regional priority. The rating criteria can vary for each of the rating systems, as well as the facility types. Each rating system is point-based, as credits are given for each green building feature and the number of total points determines whether the building certification is LEED Silver, Gold, or Platinum (the highest level).

Energy Star

Energy Star is offered through the Department of Energy and the Environmental Protection Agency to protect the environment through energy-efficient products and practices. Energy Star scores are based on 1–100 points in operating conditions, regional weather data, and other important considerations. Energy Star scores assesses how a building is performing as a whole: such as its assets, its

operations, and how people inside use it. To be certified as Energy Star a building must have a score of 75 points or higher, indicating that it performs better than at least 75 percent of similar buildings nationwide. The certification lasts for one year. Energy Star certified buildings save energy and money and help protect the environment by generating fewer gas emissions than typical buildings.

Energy Star also has a voluntary labeling program for energy-efficient products, such as consumer appliances, residential furnaces and air conditioners, office equipment, lighting, and electronics. To qualify for the Energy Star label, a product must meet energy efficiency requirements established by Energy Star product specifications.

Green Globe

The Green Globe certification program is a green rating assessment and is offered through the Green Building Initiative. Green Globe is a structured assessment of the sustainability performance of a building and ensures energy conservation, lower water consumption, responsible use of materials, and efficient use of project team time. Businesses can monitor improvements and document achievements leading to certification of their enterprises' sustainable operation and management. It consists of three categories, including new construction, existing buildings, and interiors. To qualify, a building must meet at least 35 percent of the program's 1,000 available points. Based on the number of points achieved, a building becomes eligible for certification of one, two, three, or four Green Globes. Green Globe certification program is similar to LEED; however, it requires a third-party onsite assessment, and a postassessment.

BREEAM

BREEAM (the Building Research Establishment Environmental Assessment Method) is an international program that recognizes sustainable buildings and infrastructure projects. BREEAM was first published by the Building Research Establishment (BRE), and is the world's longest established method of assessing, rating, and certifying the sustainability of buildings. It is an assessment undertaken by independent licensed assessors using scientifically based sustainability metrics and indices that cover a range of environmental issues. Its categories evaluate energy and water use, health and well-being, pollution, transport, materials, waste, ecology, and management processes. The certification is based on a star rating system with a designation of "pass," "good," "very good," "excellent," or "outstanding." The categories of BREEAM are on new construction, in-use, or refurbishment projects.

Living Building Challenge

The goal of the Living Building Challenge is to create living buildings that improve the environment rather than just to reduce harm. The Living Building Challenge certification program is based on seven performance areas, referred to as *petals*. The "petals" include place, water, energy, health + happiness, materials, equity, and beauty. Projects must be operational for at least 12 consecutive months prior to assessment to verify compliance. All Living Building Challenge projects must be holistic and must achieve all seven petals to qualify.

National Green Building Standard

The National Green Building Standard is a sustainable building certification from the National Association of Home Builders and is for residential properties only. This includes single-family homes, multifamily properties, and mixed-use developments. Like LEED, it has four different levels of certification, ranging from Bronze to Emerald. It provides independent, third-party verification that a home, apartment building, or land development is designed and built to achieve high performance in six

key areas: Site Design; Resource Efficiency; Water Efficiency; Energy Efficiency; Indoor Environmental Quality; and Building Operation and Maintenance.

GreenGuard

The GreenGuard certification is about air quality and focuses on low-emission building materials, furniture and furnishings, electronic equipment, cleaning and maintenance products, and medical devices for breathing gas pathways. The Underwriters Laboratory's GREENGUARD Certification program is recognized and referenced in numerous building programs, standards and specifications around the world. Products with GREENGUARD Certification or GREENGUARD Gold Certification can contribute to the achievement of points in established green building rating systems, such as LEED, BREEAM, Fitwel, and others. The UL GREENGUARD Certification Program requires that products undergo independent, scientific testing and ongoing monitoring of their chemical emissions. Only products that meet UL Environment's stringent emissions standards qualify for certification.

WELL Building Standard®

The WELL Building Standard® is a performance-based system for measuring, certifying, and monitoring features of the built environment that impact human health and well-being. This is accomplished through seven core concepts, including air, water, nourishment, light, fitness, comfort, and mind. The seven concepts are comprised of 100 features. Every feature is intended to address specific aspects of occupant health, comfort or knowledge. Each feature is divided into parts, which are often tailored to a specific building type. Certification is awarded by the International WELL Building Institute and focuses on the overall impact of buildings on human health and well-being.

Fitwel

Fitwel is a new building certification program to support healthier workplace environments and improve occupant health and productivity. It integrates strategies that optimize health within a building or community and improve the health of employees, visitors, or residents as well as the surrounding community. Fitwel is a building rating system for community and commercial sites, multitenant and single tenant buildings, commercial interior space, retail, and multifamily residential buildings. The rating system addresses the design and operational strategies that enhance buildings by a broad range of health behaviors and risks.

Interior designers, along with architects, real estate professionals, facility managers, engineers, landscape architects, construction managers, lenders, and government officials, are encouraged to use building certification programs to help transform the built environment to sustainability. Federal agencies, as well as state and local governments across the country, are adopting these programs for public-owned and publicly funded buildings. Sustainable considerations within the built environment begin at the design phase of a project and are carried through in the specifications and construction drawings. It is, therefore, important that students in interior design learn how to design and apply certification standards in an environmentally responsible manner. Sustainable issues and certification standards are incorporated into relevant chapters where appropriate.

Globalization

Design has become globalized as firms are getting involved in international projects. Many firms have offices in international countries and designers at those locations. However, with today's technology, offices can be linked through digital methods for sharing project details, files, and daily communication among the various people and cultures involved throughout the world environment. Then, as needs arise, the designers will visit the locales for direct physical involvement.

Technological capabilities assist in collecting and transmitting massive amounts of information that enable designers to share their spatial creations with other firms and their clients on a global scale. However, most international countries work in the metric scale, whereas the United States mostly still uses the US (or English) units of measurement. Because of global involvement, designers may find that they have to do a project using the SI (metric) system of measurements. See Chapter 2 and the metric dimensioning system discussed in Chapter 6.

Digital Technology and Building Information Modeling (BIM)

Digital technology continues to evolve at a rapid pace in the production of new software for two- and three-dimensional modeling programs for use by interior designers and others involved in the building industry. While this book is not about any specific software, there must be some discussion of the most widely used programs and their specific details, as the majority of designers are using computers in the production of design and construction drawings.

Autodesk's AutoCAD® has been one of the most widely used CAD program in interior design and architectural firms in the United States for design and the production of construction drawings. Other popular programs used by the building and design industry include ArchiCAD® (by Graphisoft) and MicroStation (by Bentley). At this point in time, it appears these software programs will not be discarded anytime soon; however, it appears that the architecture and design industry is headed toward the technology known as BIM.

Autodesk Revit® Building, a BIM technology, is leading a CAD industry standard for interior design and architectural practice. BIM is not a specific program, but an integrated approach to design and construction drawings. It is an approach that produces database-driven, 3-D parametric models of proposed projects that address geometry, spatial relationships, sectional perspectives, unit-cost impacts, and detailed documentation with unprecedented speed. Once mastered, the technology facilitates the entire multidisciplinary interactions of a project team. Revit is available in three different formats:

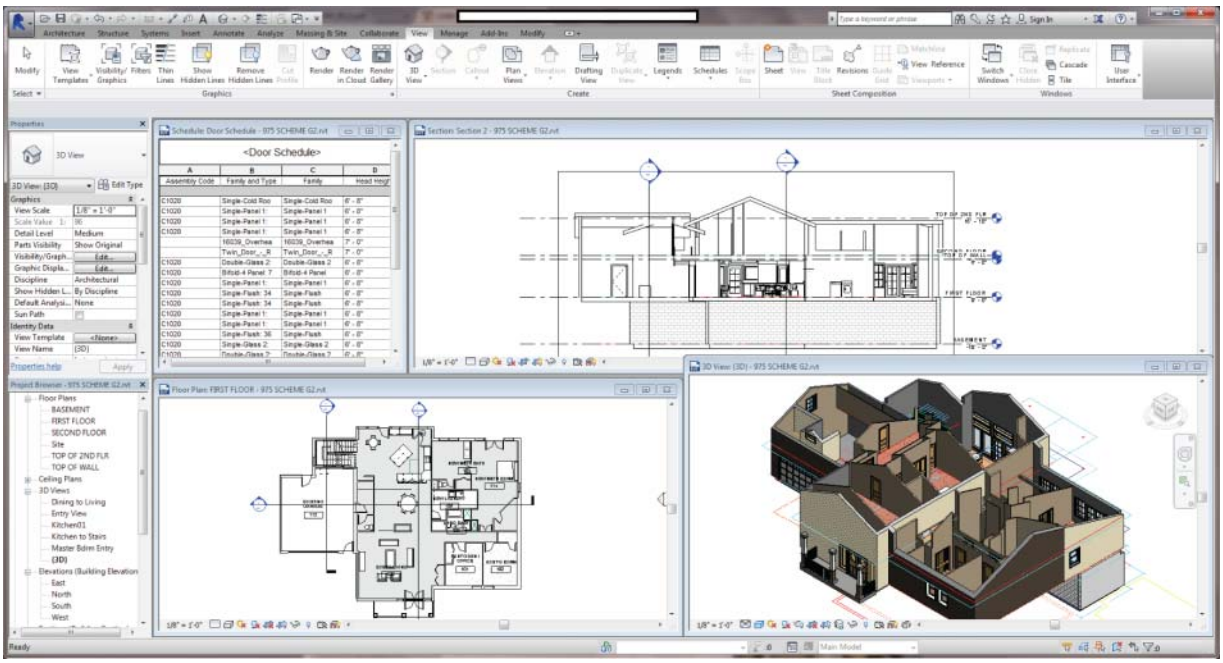


FIGURE 1.14. In this Revit example, multiple drawings and schedules can be viewed simultaneously and revised with the changes automatically done in all views and schedules. Courtesy of Lisa VanZee.

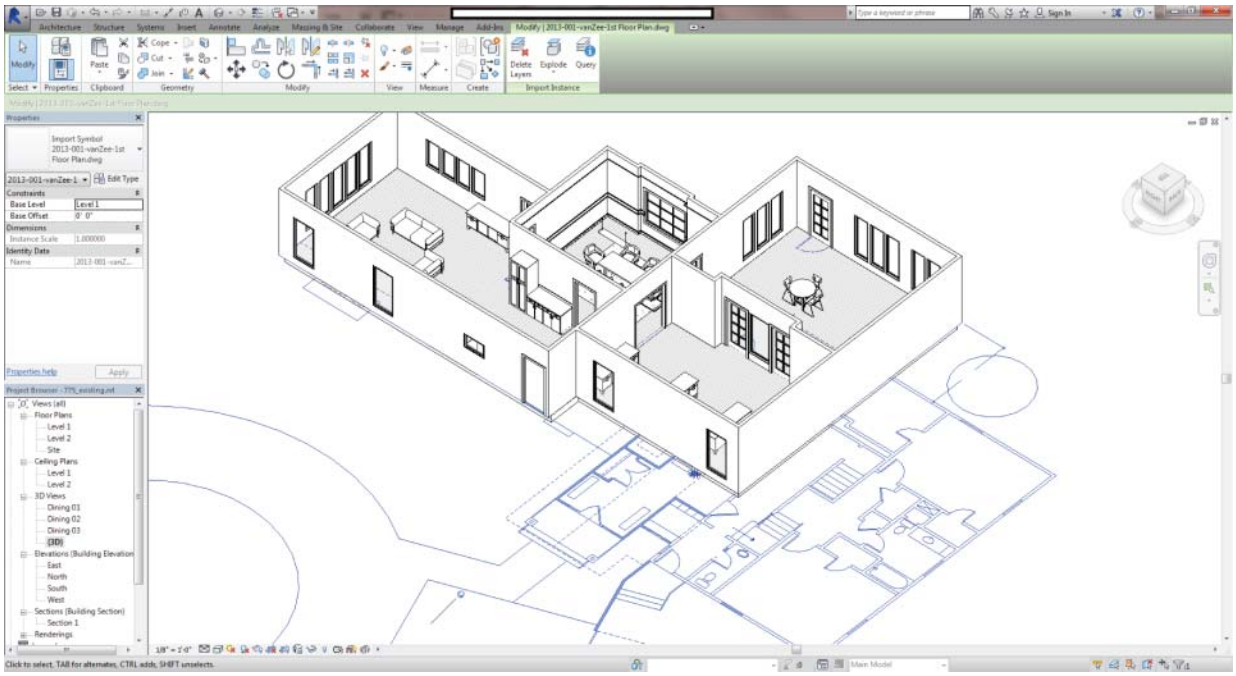


FIGURE 1.15. This student example shows the development of an addition to a plan of an existing residence. Courtesy of Lisa VanZee.

Revit® Architecture, Revit® Structure, and Revit® MEP (mechanical, electrical, and plumbing). An advantage of Revit (which stands for Revise Instantly) is that revisions made in one view or drawing are automatically integrated into related drawings and/or schedules, as illustrated in Figure 1.14. In the AutoCAD platform, this would require the changes made to one drawing be "X-referenced" to the other base drawing. As many large design firms across the country continue to implement BIM,

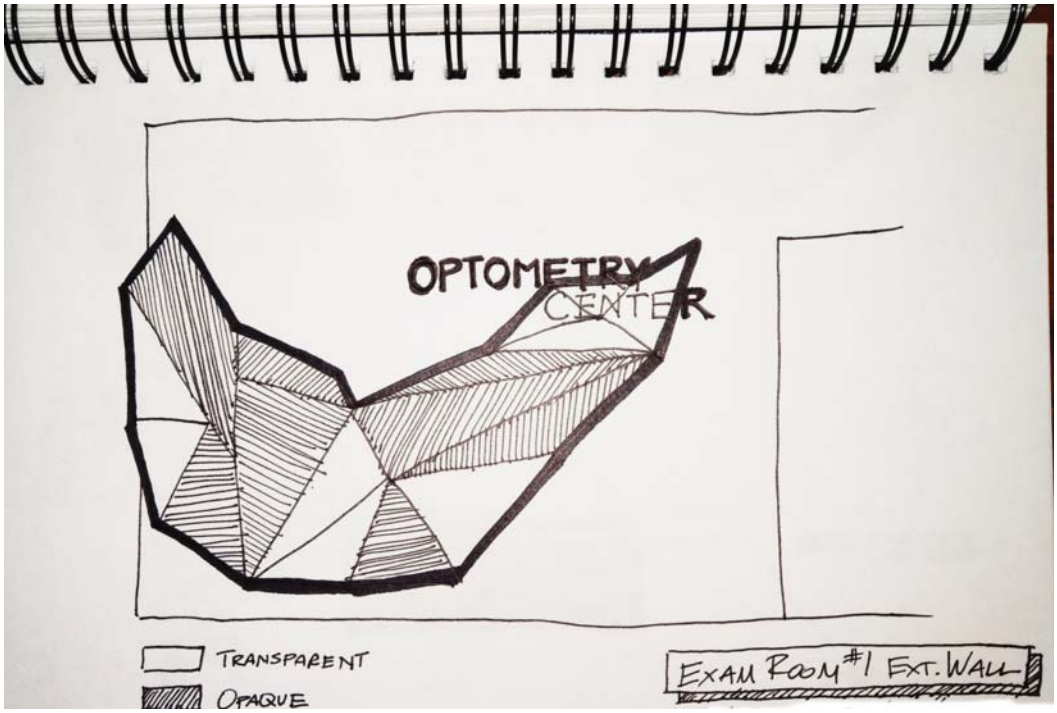


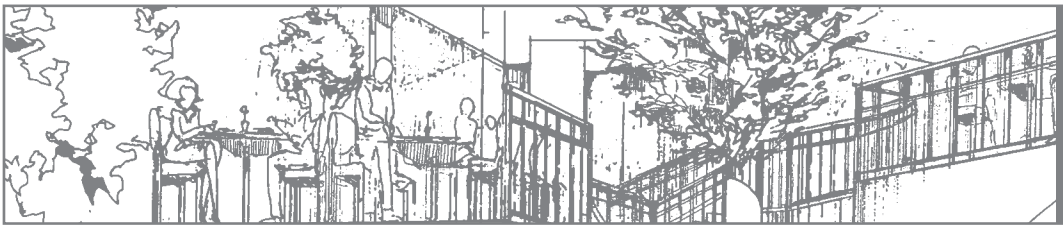
FIGURE 1.16. This parametric design sketch is an exploration for a three-dimensional wall form for a display in an optometry center. Courtesy of IA Interior Architects.

Rotunda Display

FIGURE 1.17. The design sketch in Figure 1.16 is incorporated into a presentation that includes the floor plan and a three-dimensional representation of the parametric wall displays. Courtesy of IA Interior Architects.

specifically Autodesk Revit®, into their practices, it will be essential to educate design students in this technology (Figure 1.15).

These computer programs allow designers to explore new possibilities in their design process, such as *parametric design*. Parametric design is a dynamic exploration of three-dimensional forms modified by the computational capacity of computer programs. An example of parametric design applied to an interior design project can be seen in Figures 1.16 and 1.17.



2

Drafting Equipment and Its Care

To do any job accurately and expediently, a designer must have the proper tools. Tools are important in any work—whether it be surgery or carpentry, designing, or drafting. Quality tools and equipment will also make drawing and drafting more enjoyable. Investing in good equipment for designing and drafting can benefit both students and professionals.

The advent of computer-aided design and drafting, commonly referred to as CAD, has reduced the need for much of the basic equipment described in the following pages. However, many students and professionals still prefer to draw manually in some situations, such as sketching initial design concepts or construction details. In fact, it is important for students and designers to practice and utilize hand sketching/drawing in the early design stages so they can think and ideate freely without the confines of a computer. Hand drawing and lettering is beneficial when meeting with clients. During these times, designers can sketch and communicate their design concepts and even draw changes right in front of the client. To this end, basic manual equipment and techniques are described in the next few chapters.

For hand drawing and drafting, a number of types of basic equipment are discussed. A designer or draftsperson need not buy every piece of new equipment or software available. However, you should buy a new product if it will improve your work, both in quality and efficiency. Manufacturers often produce a range of models of varying quality. You can decide which model will produce the best effects in relation to the purchase price—sometimes a model that is not top of the line will produce the best results. You should purchase tools and equipment of good quality, as they are an investment that will pay off throughout your career.

DRAWING TABLES AND SURFACES

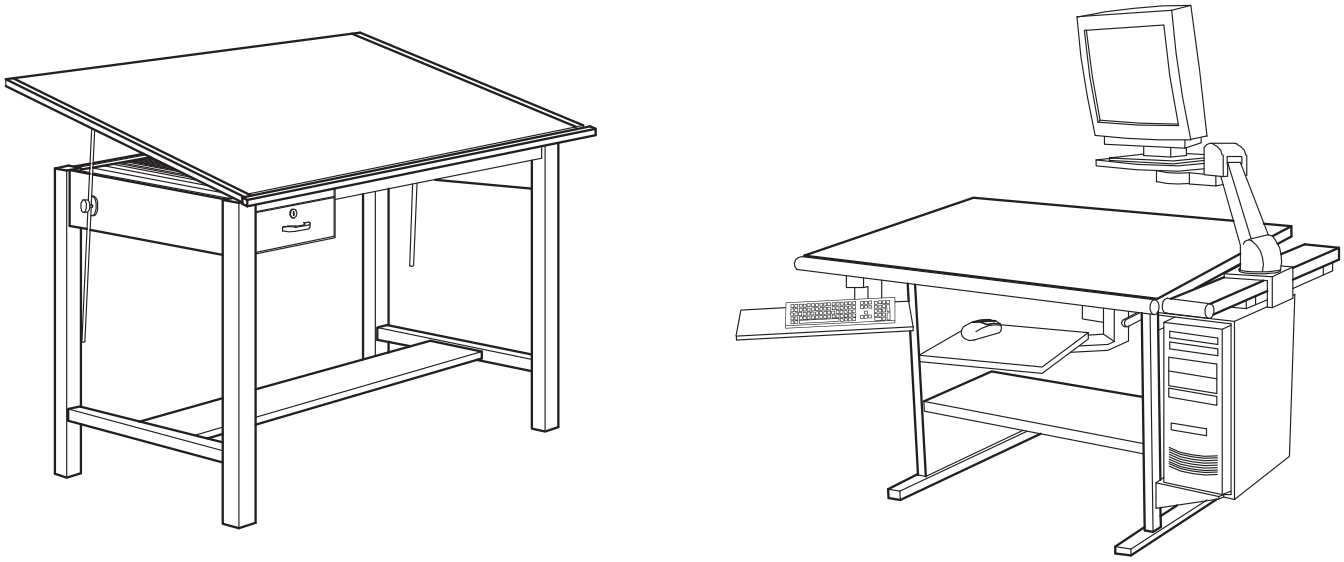
To produce quality drawings for interior design projects, it is necessary to establish a dedicated workplace. Designs can be drawn manually on a drawing board set on a tabletop surface, on a handmade drafting table, or on a ready-made drafting table. Or they can be drawn using computer drafting hardware and software that augments a drawing board or replaces it totally. In this chapter, commonly used manual drafting tables, equipment, and tools are discussed.

For interior designers, a fairly large layout and drawing surface is needed most of the time. It is vital to have a drawing surface that will hold large presentation boards and standard sheets up to 24 × 36 inches (610 mm × 914 mm). Even larger sheets may be necessary for perspective drawings and full-size furniture drawings. A drawing board or table approximately 30 × 50 inches (762 mm × 1.27 m) should be obtained if possible. This would allow adequate space around the actual drawing sheet to place and maneuver the drawing tools and materials.

Ready-made drafting tables are manufactured in a wide variety of shapes, sizes, materials, and prices (Figure 2.1). Some styles have an adjustable top and rest on four legs. Other models have a single or double pedestal base with a top that can be raised or lowered according to the height of the chair or stool. This enables drafters to sit in a chair with a comfortable back, and thus to work with less fatigue. The newer models also allow the top to tilt at various angles for comfort. This allows the drafter to work whether sitting or standing. Space-saving folding tables are also produced, although they are not generally as sturdy as the fixed models.

Manufactured tables have drawing surfaces that range in size from 30 × 48 inches (762 mm × 1.22 m) to 30 × 60 inches (762 mm × 1.52 m), and are usually made of wood or hardboard over a cellular core. However, a wood drawing surface can become scored and grooved over time, which affects the drawing quality of the surface. It is best to cover the bare wood top with a protective finish, such as plastic melamine or a vinyl drawing-board cover that gives a bit of resiliency and is easy to keep clean. The latter covering is often produced with an off-white and a colored side. Which side to leave face up is left to the individual.

FIGURE 2.1. A variety of premanufactured drafting tables are available to designers. They range from very basic with few options for adjustments to more sophisticated with electronic controls.



Drawing-board and table surfaces do not have to be manufactured, as a self-made surface can also be satisfactory and less expensive. For example, a hollow-core, flush door can be supported on blocks or handmade legs made of 2 × 4 lumber with metal brackets. However, the height and angle that suits individual work habits must first be determined, as this type of drawing area will be fixed and not adjustable.

DRAWING PAPERS AND PLASTIC FILM

Interior design drawings can be produced on paper or plastic films. The quality of paper or film will help determine the quality of line work. A variety of papers and plastic films are manufactured today in many standard sheet sizes and rolls. The choice of which to use is dependent on the designer's overall intent, office standards, and the method selected to make a copy from the original.

Papers

The type of paper selected for sketching or drawing affects the quality of the drawn image. Therefore, it is important to understand the different types of papers and film available. Drafting papers are made in a large variety of types, based on stability, translucency, permanence, strength, and cost. There are two basic categories: opaque and translucent. Opaque papers are thicker than translucent ones and can also be reproduced by photocopying. They are more suitable for plotting directly from a computer (in single sheets or rolls), and for concept and presentation drawings, as they are available in a variety of colors as well as sizes. Some opaque papers are made smooth on one side and rough on the other. The smooth side is more appropriate for inking, and the rough side for pencil drawings. Most papers will accept ink or pencil. However, the quality of their application and possible bleed-through varies according to the composition of the paper and its thickness.

Translucent papers, such as tracing paper and vellum, are used primarily for hand sketching a drawing. They can be reproduced photostatically, depending on the size of the sheet, or by computer printing after scanning the drawing. Tracing paper is generally a natural, untreated translucent paper. It is used primarily for exploratory ideas and sketches. It is commonly sold in inexpensive rolls (in white or yellow shades) and is called "trace," "trash," "flimsy," or "bum wad." It is fairly strong and durable, but not as transparent as vellums and will not produce line work as crisp and clear as vellums.

Vellum is a translucent tracing paper that is treated to improve strength, surface texture, and transparency. Vellums have a high rag content that gives them strength so they can withstand erasing. Vellum is sold in rolls or standard sheet sizes and can be used for hand or computer drafting. Standard sheet sizes for architectural drawings are shown in Table 2.1.

TABLE 2.1. STANDARD PAPER SIZES

Type	Architectural Drawing Sizes (In.)	Type	Metric Sizes (mm)
A	8–1/2 × 11	A4	203 × 279
B	11 × 17	A3	279 × 432
C	17 × 22	A2	432 × 559
D	24 × 36	A1	610 × 914
E	36 × 48	A0	914 × 12,193

Plastic Films

Plastic drafting films are tough, translucent, polyester sheets. Their thickness commonly ranges from 0.002, 0.003, 0.004, 0.005, and 0.0075 inch to 0.05, 0.08, 0.10, 0.13, and 0.19 mm. The sheets may be frosted on one side and smooth on the other, or frosted on both sides. Drawing is done on the frosted side, which accepts pencil or pen more readily than the smooth side.

Special plasticized lead pencils were at one time commonly used with plastic films, but they are not as prevalent as they once were. These are discussed in the paragraph under "Leads" in the next section. Special ink is also available for drawing on plastic film. Both pencil and ink lines are very clear and crisp on plastic films, and produce very clear, clean prints. Plastic films are sold in rolls and standard sheet sizes. The films are generally more expensive than tracing paper or vellum, and are used primarily for permanent records or tough originals for multiple reproductions.

PENCILS, LEADS, AND PENS

Pencils are one of the most basic and primary drawing tools of the professional designer. The type of pencil lead or pen is important to the designer as it controls line thickness and the type of stroke to create lines and convey specific information. There are three basic types of pencils available to a designer for producing quality drawings (Figure 2.2). The selection is a matter of preference and the particular level of performance needed by the user.

Pencils

Wood-Cased Pencils

The oldest manufactured pencil is of wood with a lead encased inside. It is seldom used for repetitive work in today's offices, yet is still a reliable tool for occasional use for convenience, and when pencil line control or making quick notes is needed. To expose the lead, the wood shell is cut away by a draftsman's pencil sharpener. However, the sharpener only cuts the wood and does not touch the lead. To "point" the lead, the designer can use a lead pointer, which forms the lead into a conical point. If a wedge point is desired, rubbing the lead on sandpaper can form it. Wood-cased pencils

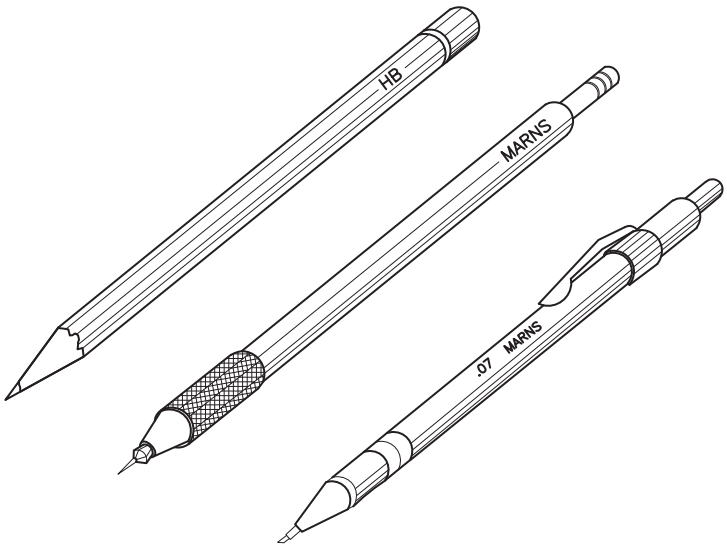


FIGURE 2.2. The three types of pencils available for designers are the wood-cased pencil, the traditional leadholder, and the fine-line mechanical pencil.

come in a variety of different lead weights, ranging from 9H (extremely hard) to 6B (extremely soft). These leads are explained later in this chapter.

Traditional Leadholder Mechanical Pencils

Traditional mechanical pencils are made of metal or plastic, with special individual leads inserted in a permanent holder. Different lead weights may be inserted to produce a variety of sharp line weights. Pencil leads are graded from 9H (hard) to F (firm) to 6B (soft). Beginners should sharpen the point frequently for a clear, sharp line until they develop the ability to rotate the pencil while drawing to wear the point more evenly. The lead is sharpened by rubbing and rotating it on sandpaper, on regular paper, or in a special mechanical lead pointer. When using sandpaper to sharpen the lead, the lead should be slanted at a low angle to achieve a good taper and point.

Fine-Line Mechanical Pencils

This type of mechanical pencil does not require sharpening and is loaded with multiple leads of the same diameter and hardness. The pencil generally is made to hold 0.3-, 0.5-, 0.7-, or 0.9-mm diameter lead. The size of the lead determines the line width, with 0.3 being the thinnest and 0.9 being the wider line. This type of pencil is also generally rotated while drawing, and capable of producing consistently sharp, clean lines. Like the traditional leadholder, the mechanical pencil offers the convenience of a steady supply of lead as the leads are inserted in the bottom of the holder and pushed out the tip by pressing a button on the end of the pencil. It is the most widely used pencil in today's schools and offices for sketching, note-taking, and even drafting.

Leads

A variety of leads are available for both wood and mechanical pencils. Leads used on tracing paper and drafting paper are composed of graphite. Leads range in grades from 9H (extremely hard) to 6B (extremely soft) (see Table 2.2).

TABLE 2.2. PENCIL-LEAD WEIGHTS

9H 8H 7H 6H 5H 4H	Hard pencil leads are used for light layouts and drawings required a high degree of accuracy.
3H 2H H F HB B	Medium Leads are used for sketching, architectural line work, lettering, and general purposes.
2B 3B 4B 5B 6B	Soft leads are used for sketching, rendering, and graphical elements.

*The gradations can vary with different brands and types of drawing media. When in doubt, try a sample or test first.

The softer the lead, the darker the image or line it will produce. For most drafting work, where clean, crisp lines are necessary, H and 2H leads are used. For sketching, softer leads are better, such as F and HB. Very soft leads, such as the B grades, are best for pencil renderings and shadowing work. For light, preliminary layout work, 3H and 4H leads are best.

Generally, the more "tooth" or roughness a paper has, the harder the lead should be. Also, the harder the drawing surface, the softer the lead feels. If you are in high-humidity conditions, the apparent hardness of the lead tends to increase.

As noted before, there are special plastic-leaded pencils available for drawing on plastic drafting film, for those who still use this technique. These plastic leads are available in five grades of hardness, ranging from E1 (soft) to E5 (super-hard). They are water-resistant and bond well to the plastic film. A vinyl eraser is also available for use with these special leads.

Pens

Some designers prefer ink and use a technical fountain pen (Figure 2.3), as it is capable of precise line width. It can be used for both freehand and drafted ink drawings. As with the drafting pencils, pens are available in a variety of forms and price ranges. However, most technical drawing pens consist of a tubular point, which has an ink-flow-regulating wire inside it. The size of the tubular point determines the finished width. Standard widths of ink lines are measured according to a line-width code, such as 0.30/00, which means the line width is 0.3 mm, or the American standard size of 00. Metric widths range from 0.13 to 2.0 mm, while the American standard widths range from 000000 to 6. These sizes correspond to line-width designations developed by the American National Standards Institute

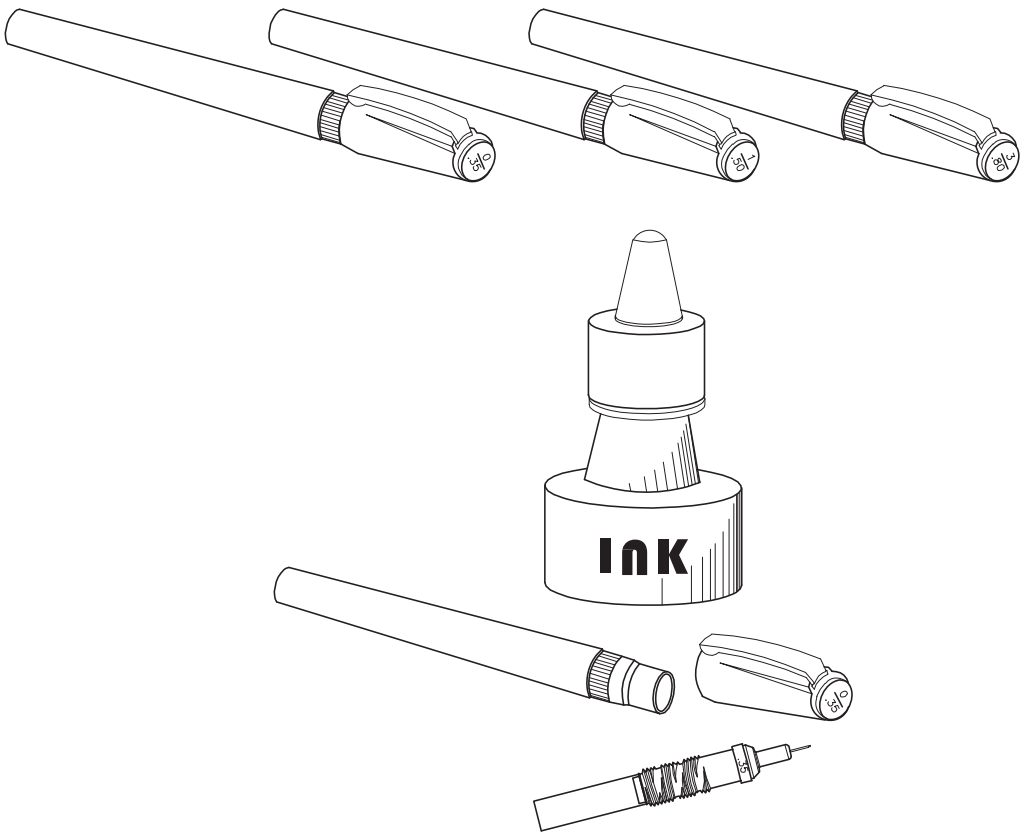


FIGURE 2.3. Technical fountain pens and ink refill.

(ANSI) and are coordinated with metric sizes. For a good starter pen set, a good range of point sizes would be 3 × 0 (0.25 mm), 2 × 0 (0.3 mm), 1 (0.45 mm), and 3 (0.8 mm). Technical pens that produce the same line widths are also produced with felt tips. These are less costly; however, their felt tips tend to wear out faster than the metal tips—sometimes producing blurred lines and faded ink results.

An advantage to using ink, especially on plastic drafting film, is that it will last for several years longer than pencil, will not smudge, and will produce excellent reproductions. When using technical pens, remember to keep points screwed in securely to prevent the ink from clogging. Always replace the cap firmly after each use to keep the ink from drying, and store the pens with their points up when not in use.

Use a good waterproof, black drawing ink. Good, nonclogging ink that is specially made for use in fountain pens and technical pens is the best choice.

PARALLEL BAR, T-SQUARE, AND DRAFTING MACHINES

It is important to make sure lines on design drawings and construction drawings are exactly straight, and when required, parallel. To make sure lines are straight in a horizontal, vertical, and angular direction, there are several tools available. The most common of these instruments are the T-square and parallel bar (Figure 2.4).

Another device, called a *drafting machine* (Figure 2.5), is also sometimes used.

T-Square

A T-square consists of a straightedge with a head set at right angles that can be set flush against the edge of a drawing board or table, but is not installed permanently. The head is generally very sturdy and immovable. T-squares come in different lengths to coordinate with various drawing board sizes. The most common sizes are 36 and 42 inches (0.91 m × 1.07 m). They are available with opaque or transparent edges, the latter making it easier to see through to existing lines when spacing them by eye. To use a T-square, hold it with one hand (usually the left) at the head, so it can be moved into position and held in place while a line is drawn along the straightedge with the other hand. The T-square is inexpensive and portable, which makes it convenient for students. However, in modern practice, the T-square has been replaced by the parallel bar and the drafting machine as they do not require constant hand pressure to steady the head and keep it in place.

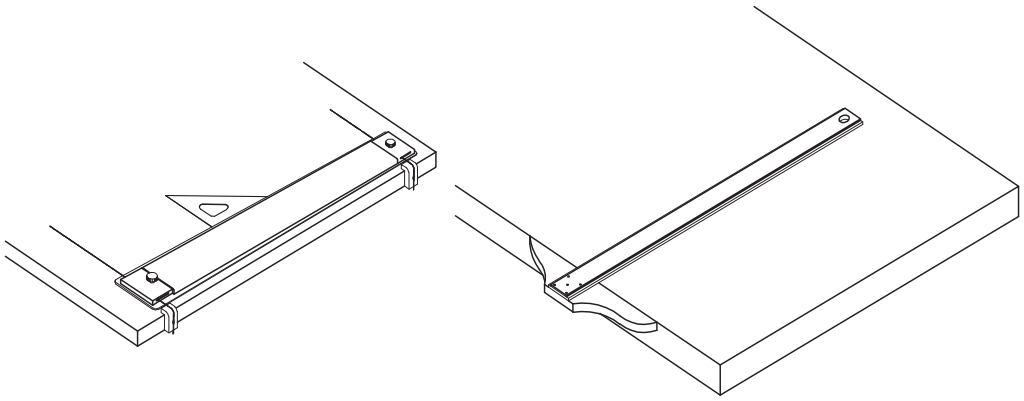


FIGURE 2.4. The T-square and the parallel bar are used to create horizontal straight lines and as a guide for vertical lines.

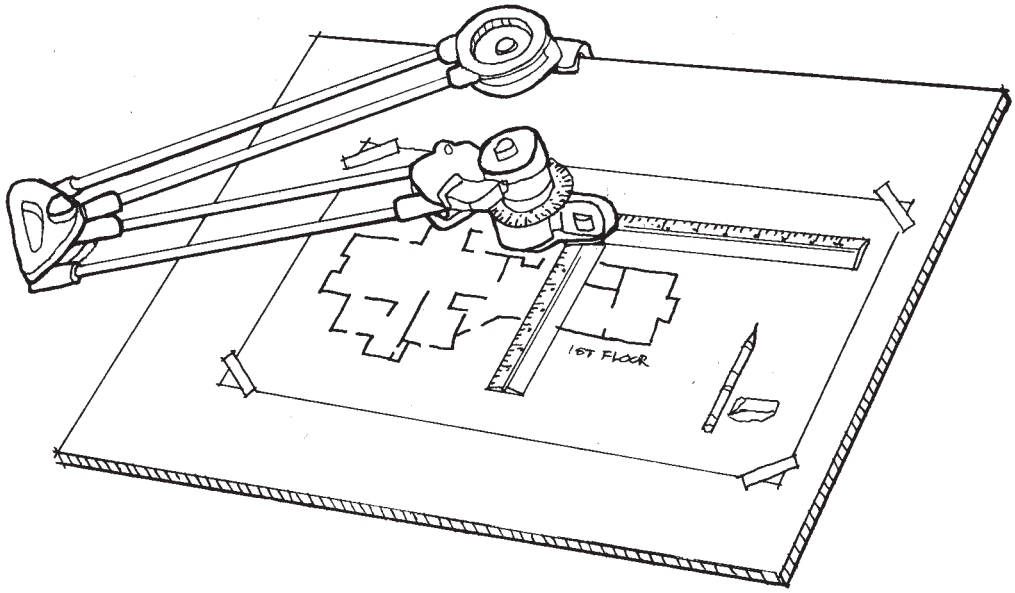


FIGURE 2.5. An arm-track drafting machine can produce horizontal, vertical, and angular lines.

Parallel Bar

A parallel bar is attached by cleats and pulleys to a particular drawing surface. The bar moves up and down on thin wire that runs over pulleys inside the bar. When properly installed, the bar can be moved up and down the drawing board and always be parallel with the top of it. Parallel bars are available in a variety of lengths to fit different drawing board sizes. The parallel bar is easy to use. It permits the drafter to draw long horizontal lines and serve as a base for the placement of triangles and other instruments for precision drawing.

Drafting Machine

A drafting machine is a combination of several conventional drafting tools. It is fixed to the drawing board and consists of vertical and horizontal blades that serve as scales for linear measurement, eliminating the need to use a triangle and T-square for drawing vertical and horizontal lines. There is also a scale in angular degrees on the head that replaces the protractor.

There are two basic types of drafting machines—the arm type and the track type. The arm type has two arms that pivot in the center with a head at the end of the lower arm that is clamped to the top edge of the drafting table. The drafter moves the head up and down and right and left. The head and the scales on it remain parallel to their original setting. The track type has a horizontal track mounted to the top edge of the drafting table with a vertical track attached to it that slides left and right. The head with the scales on it is fastened to the vertical track and slides up and down.

Drafting machines are available for right- or left-handed people. Right-handed people hold the head in place with the left hand. Left-handed people hold the head in their right hand with the scales facing the opposite direction.

The scales on drafting machines can be set at angles by releasing a lock, pressing a release button, and turning the head. Frequently used angles, such as 30, 45, and 60 degrees have positive set points.

Scales are available in several lengths in either architectural or metric measurements. They are also available in either plastic or aluminum finishes.

TRIANGLES, TEMPLATES, AND COMPASSES

A variety of other drawing tools are available for constructing vertical or angled lines, as well as circles, curvilinear shapes not based on fixed-radius circular forms, and other special shapes, such as representations of furniture, plumbing fixtures, and other interior equipment and furnishings.

Triangles

A triangle is a three-sided instrument used with the T-square or parallel straightedge for drawing vertical and angular lines (Figure 2.6). The most common are 45-degree and 30/60-degree triangles, each named for the angles they form. A range of sizes is available, from 4–12 inches (102–305 mm) with a size of 8 or 10 inches (203 mm or 254 mm) being in the middle of the range. Their size is based on the length of the longest side of the right angle. It is best to begin with the middle range of 8 or 10 inches (203 mm or 254 mm); then, larger and smaller sizes can be added as needed. For example, small triangles, such as 4 inches (102 mm), are useful for hand lettering and crosshatching small areas.

Adjustable triangles can be set for any angle from 0 to 45 degrees. The adjustable triangle is convenient for situations requiring a variety of sloping lines, such as for stairs or slanted ceilings.

Some triangles are available with recessed edges for use when inking. This keeps the edge up off the paper so the ink doesn't run under the triangle and become smeared. Triangles are available in

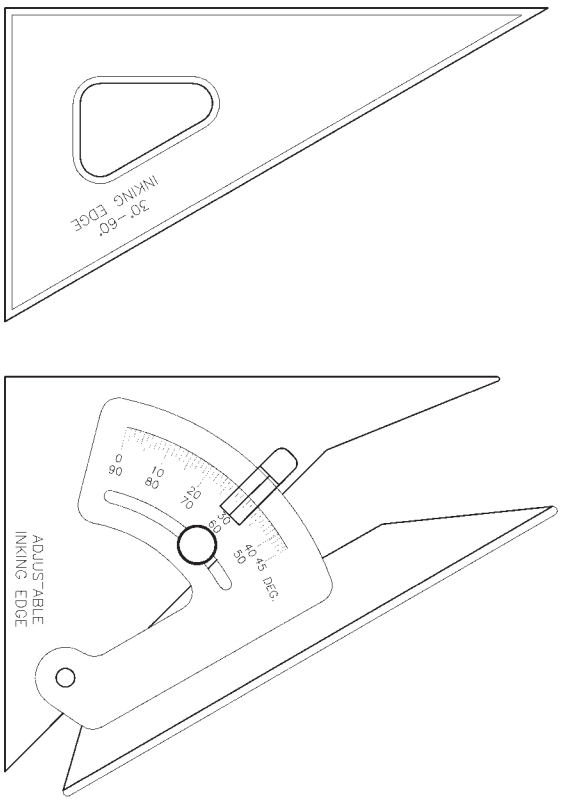


FIGURE 2.6. Triangles are used to create straight lines when drawing. When used with a parallel bar or T-square, angular and vertical lines can be drawn. Shown on the left is a fixed 30/60 triangle; on the right is an adjustable triangle.

a clear (nonyellowing) or colored plastic. They are scratch-resistant and generally have good edge retention. They should not be used as a cutting edge as they are easy to nick, which won't keep the edge straight. They must be used and stored carefully for a long life.

Templates

Templates are in prepunched patterns representing various shapes commonly used in interior design and architectural plans (Figure 2.7). Templates help to speed up the drafting process and aid in the production of accurate drawings. There are a variety of templates available, some of which are used regularly, while others are needed for special purposes only. There are templates that are used to draw circles, squares, windows, doors, electrical symbols, plumbing fixtures, furnishings, and hundreds of other features.

The circle template is a very basic and highly useful time-saving device for drawing accurate circles or various sizes as well as curves that are parts of circles. Circles range in size from 1/16 inch (1.58 mm) up to 2 inches (50.8 mm) in diameter. Ellipse templates come in similar sizes, but since ellipses vary from near flat to near circular, a series of templates may be needed for each size. However, a single guide with the most commonly used proportions is available.

French-curved templates are excellent tools for drawing irregular curved lines that are not part of a circle or ellipse. These guides consist of at least a dozen traditional forms that can help a designer draw almost any flowing curve needed. There are also flexible drawing curves available that can be bent as needed to fit an irregular curved line. They can hold the shape as the line is drawn, then straightened out after use.

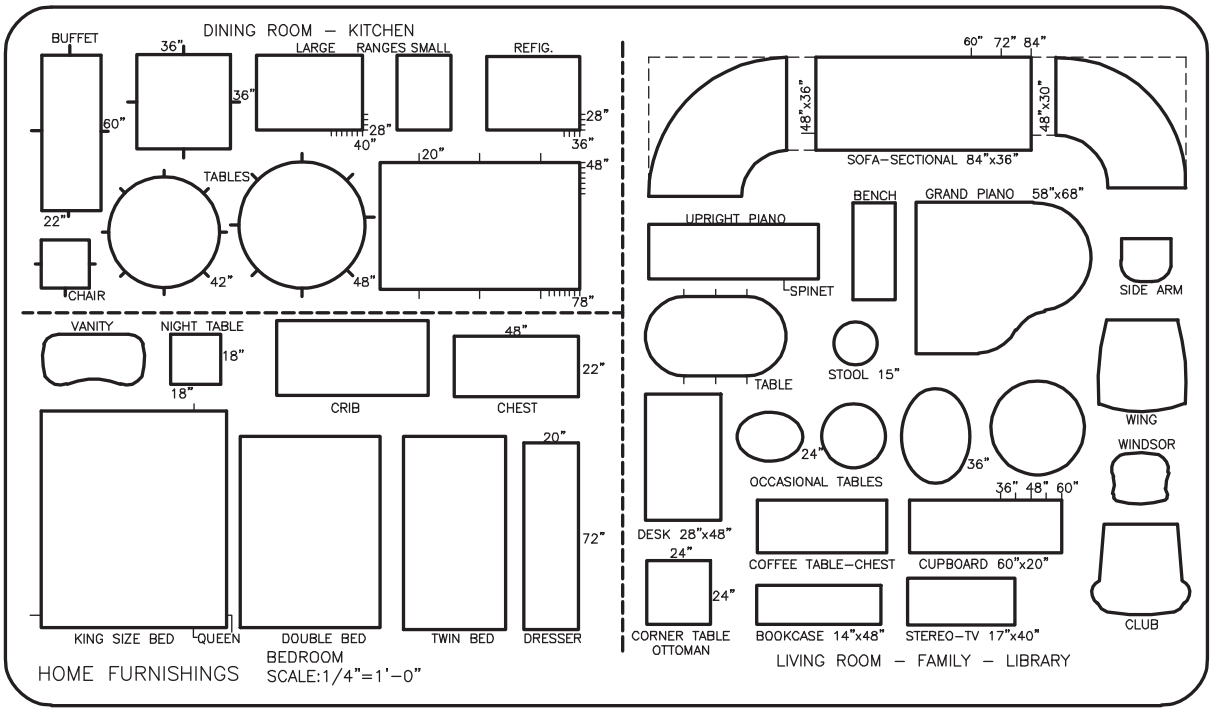
Other useful templates include forms for both residential and commercial furniture as well as plumbing fixtures, retail fixtures, and lighting and electrical symbols. Lettering templates are also available, but even though they may be convenient they often appear stiff and are not frequently used in design offices. Lettering templates are best used for very large letters and numbers that may be difficult to form freehand.

Compass

A compass is an inverted V-shaped instrument used for drawing circles and arcs (Figure 2.8). It has a sharp pin at the end of one leg to establish the center of a circle and a leadholder at the end of the other for the pencil lead. A special device can be attached to some compasses, which will allow technical pen points to be used with the compass. The best way to use a compass is to mark a center point and the radius desired on a piece of paper and adjust the compass to that measurement by setting the pin on the center point and setting the pencil or pen point on the radius mark. Hold the compass firmly at the top, leaning it a little in the direction that the circle will be drawn, then rotate it. Generally, rotating it in a clockwise direction is easier. Press hard enough to get the desired line weight. Be careful to match line weights of circles or arcs to the rest of the drawing.

SCALES

Measuring tools are extremely important to the interior designer, because a designer's plans, elevations, sections, and details must always be drawn with all their dimensions at the same fractional part



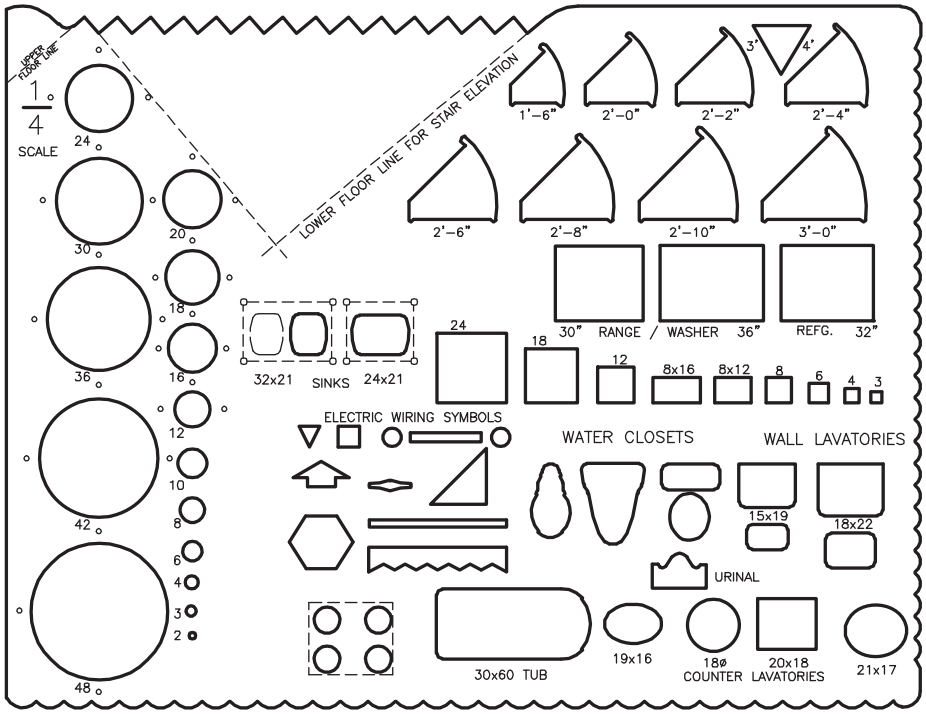


FIGURE 2.7. Templates are used to speed up the drafting process by tracing the punched shapes directly onto a drawing. Templates come in a variety of patterns and scales.

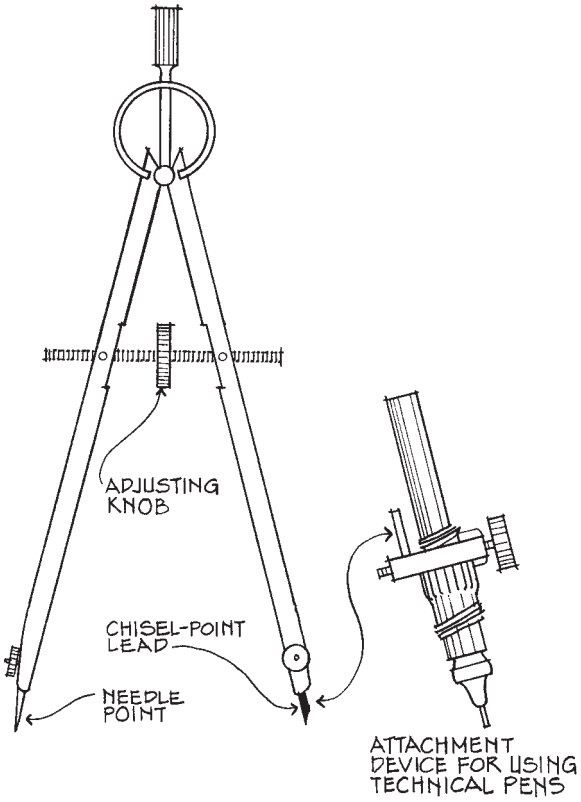


FIGURE 2.8. Compasses are used to draw circles and arcs; this illustration shows a compass with a lead point and the attachment used when drawing with ink.

of their real (full-size) dimensions. Architectural and interior design line work generally represents objects that are much larger than the drawing paper; therefore, a proportional measuring system must be used. This scale of the drawing is always stated on the drawing. When a drawing is drawn to scale, this means that all dimensions on the drawing are related to the real object, or space, by an appropriate selected scale ratio. For example, when drawing at a scale of $1/8'' = 1'$, each 1/8-inch increment in the drawing represents a foot in the full-sized object.

The term *scale* also refers to the physical measuring device used by designers to accurately reduce linear distances to their correct scaled lengths. Scales are special rulers that can be used for measuring in a variety of units and that enable the designer to draw an object larger than, smaller than, or the same size as the real (full-size) object. Scales are calibrated in inches or millimeters much like a regular ruler. They are available in either a flat or triangular shape. Triangular scales are very popular because as many as four scales can be printed on each face. Generally, a triangular scale has as many as 11 different scales on it. The shape also makes them convenient to pick up and use. Flat scales generally have either a two-bevel or four-bevel edge, depending on the number of scales they carry. Good-quality scales must have sharply defined graduations that are close to the edge for accurate measurements. Scales are not meant to be a straightedge and should never be used as a pencil or inking guide when drawing a straight line.

There are several different types of scales, but the interior designer will mainly use the architect's scale, engineer's scale, and metric scale.

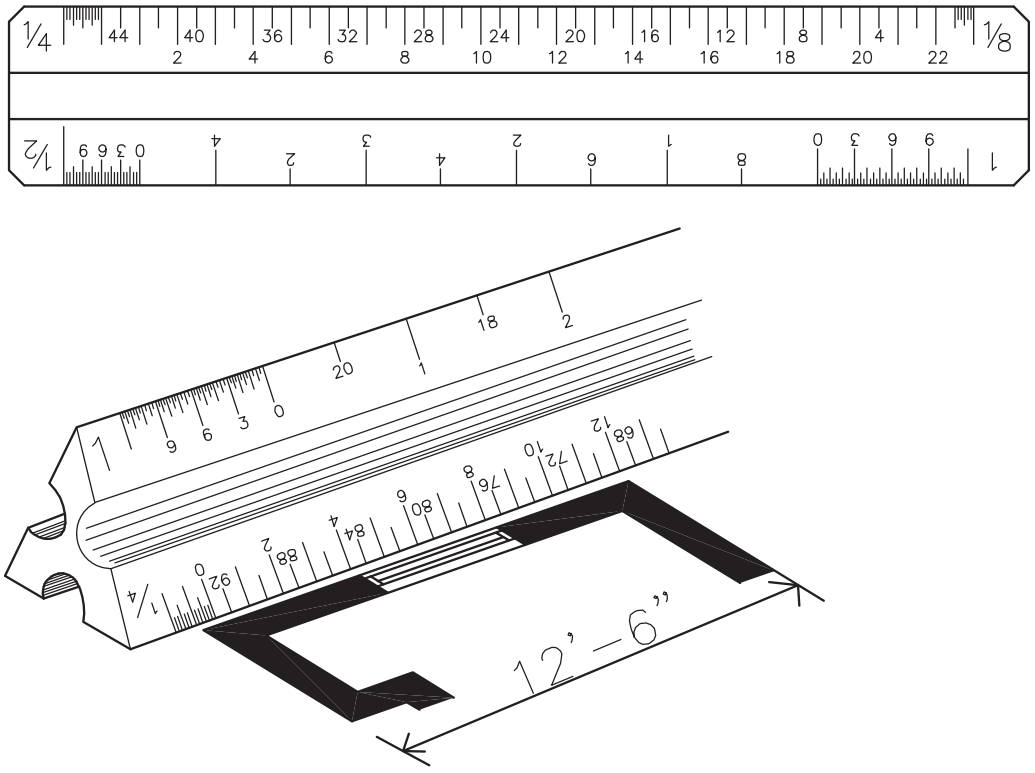


FIGURE 2.9. The architect's scale is based on feet and inches, and provides a number of common reduced scales as the ruler is rotated and flipped.

Architect's Scale

The architect's scale (Figure 2.9) is the one most frequently used by an interior designer. It is used for laying out accurate design and construction drawings in feet and inches. Architect's scales generally contain 11 different divisions in which each major division represents 1 foot. The major divisions are indicated as 3/32, 1/16, 1/8, 3/16, 1/4, 3/8, 1/2, 3/4, 1, 1–1/2, and 3. Each one of these divisions represents 1 foot on the scale. For example, the 1/4 scale means 1/4 of an inch on the scale represents 1 foot.

When using the architect's scale, begin at the 0 point, then count off the number of feet using the major subdivisions that are marked along the length of the scale. The scaled inches are located on the other side of the 0 point.

Engineer's Scale

The engineer's scale (Figure 2.10) is a full divided scale, as it has the inches marked along its edge, which are then divided into decimal parts of an inch. The engineer's scale generally contains six different divisions/scales. These divisions are indicated as 10, 20, 30, 40, 50, and 60. These divisions mean "parts to an inch." For example, the 40 scale means 1 inch = 40 feet. As there are 40 subdivisions within an inch, each mark represents 1 foot. This scale can also be used to represent larger units such as 400 or 4000 feet per inch. Engineer's scales are generally used for drawing large-scale site plans and maps.

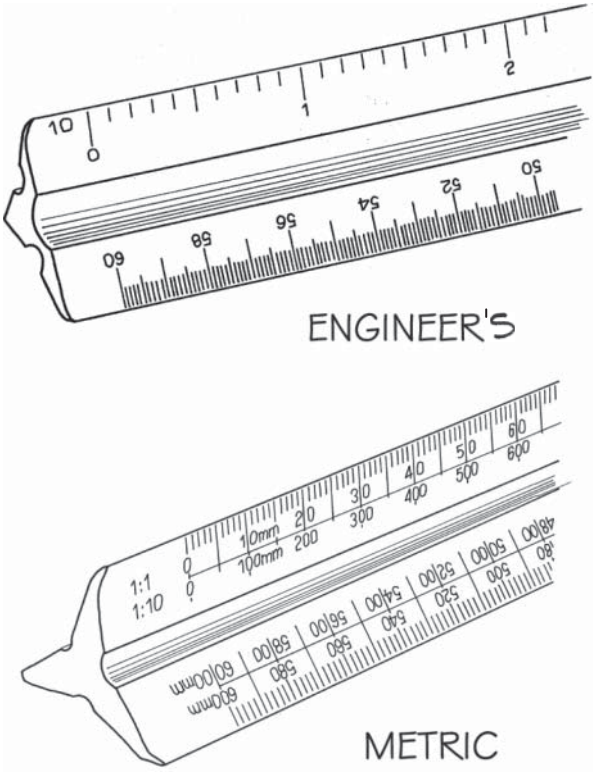


FIGURE 2.10. The engineer's scale is calibrated in decimal units, whereas the metric scale is calibrated in metric units.

Metric Scale

Metric scales (also shown in Figure 2.10) are used when drawing architectural and interior plans in metric units. The millimeter is the basic unit of the metric scale. Metric scales are based on ratios, such as 1:50, which means 1 mm on the scale represents 50 mm. Typical ratios are 1:10, 1:25, 1:50, 1:100, 1:200, and 1:500. To enlarge a drawing, scales are available in 2:1 and 5:1 ratios. Since metric scales are based on the metric system, using the base 10, it is possible to use single-ratio scales for other ratios. For example, a 1:1 scale with 1-mm markings could also be used to represent 1 mm, 10 mm, 100 mm, or 1,000 mm. A 1:2 metric scale could be used for 1 mm to represent 20 mm, 200 mm, and so forth.

ERASERS, ERASING SHIELDS, AND BRUSHES

To be able to erase errors and correct drawings is very important to the interior designer. Erasability is one of the key advantages of using a pencil or pen for drawings. Erasers, erasing shields, and brushes are convenient tools of almost equal importance.

Erasers

A wide variety of both rubber and synthetic erasers is available. A good eraser must be capable of completely removing pencil or ink lines without leaving smudge marks or roughing the surface of the paper. For vellum drafting paper, soft rubber erasers should generally be used. There are also special erasers designed to remove ink. However, be careful, as these erasers are too abrasive for some drawing surfaces. Some ink erasers claim to have a solvent incorporated into them for better erasing of ink. Erasers are available in either block form or stick form inserted into a holder much like a leadholder (Figure 2.11). Vinyl and other plastic erasers are designed for use on plastic drafting film.

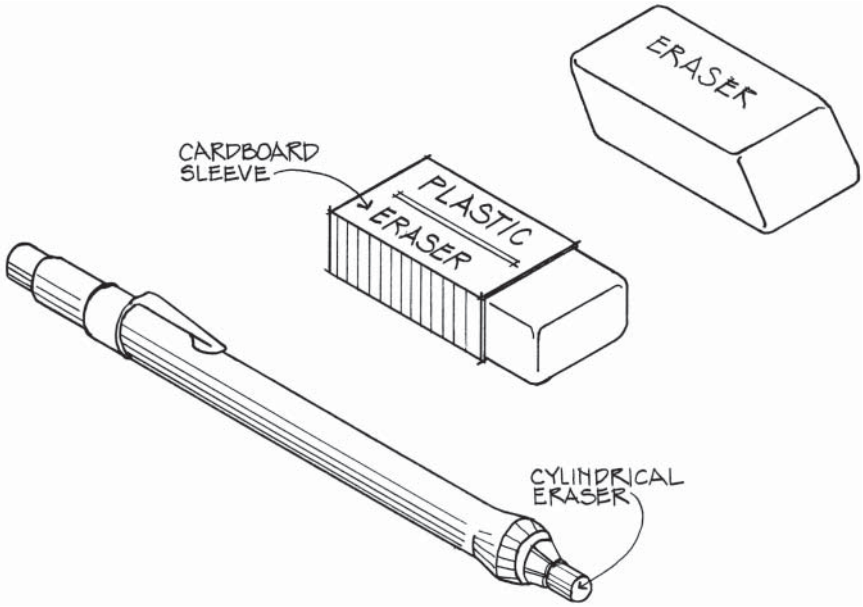


FIGURE 2.11. Erasers come in various shapes and sizes, and different kinds can erase pencil or ink. Shown are a mechanical eraserholder, a plastic block eraser in a sleeve, and a basic block eraser.

Electric erasers are extremely useful when a great amount of erasing is necessary. Electric erasers are small handheld tools that hold long round lengths of eraser that are rotated when turned on. The cordless variety is the most convenient (Figure 2.12).

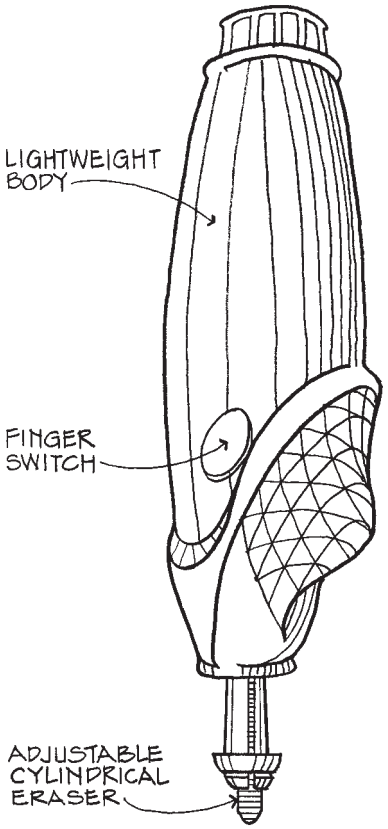


FIGURE 2.12. An electric eraser can be very handy when erasing large areas of a drawing, and is especially convenient when cordless.

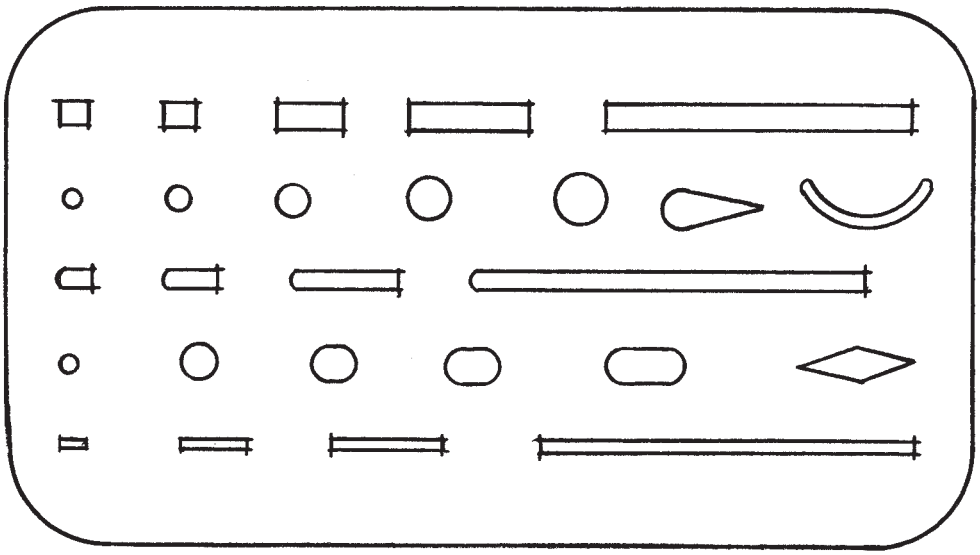


FIGURE 2.13. An eraser shield allows for precise erasing as it shields the parts of the drawing that are to remain. The prepunched holes allow the designer to erase only those lines that need to be erased.

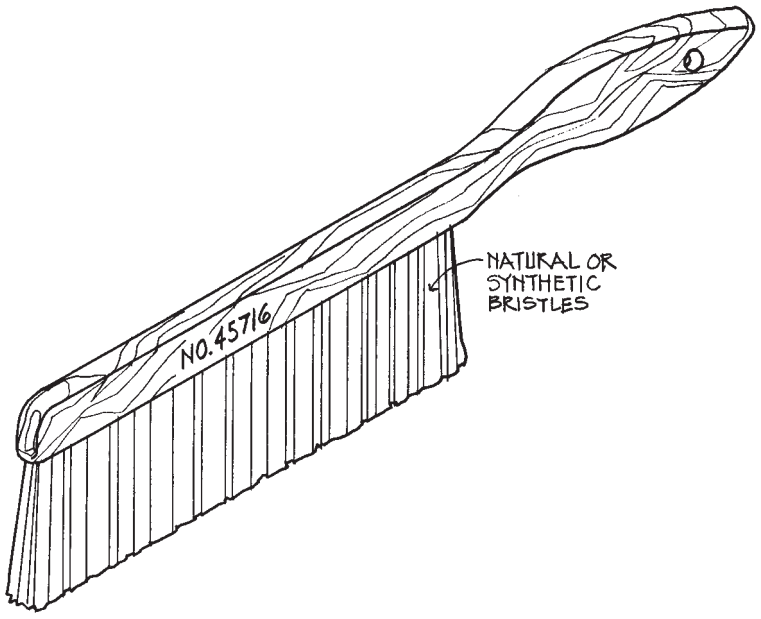


FIGURE 2.14. Dusting brushes can be used to clean an area in preparation for drawing or to clean erasure crumbs from a drawing in process.

Erasing Shields

A small metal or plastic card with prepunched holes and slots is used to erase precise areas of a drawing, as shown in Figure 2.13. The prepunched holes come in a variety of sizes and shapes, allowing the designer to erase small details and control the erasure up to a particular point. It is also helpful in protecting the drawing surface while using an electric eraser. Although the transparency of a plastic shield can be convenient, a metal shield generally lasts longer.

Brushes

A dusting brush is useful for keeping drafting surfaces clean and free of debris (Figure 2.14). Erasure crumbs are sometimes left on a drawing surface to help prevent smudges, but if they become too abundant, they can cause lines to skip, so it is helpful to brush the drawing surface often.