

THE PROFESSIONAL HANDBOOK OF ARCHITECTURAL WORKING DRAWINGS

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Professor of Architecture, Los Angeles Harbor College

Richard M. Linde

A.I.A. Architect, Richard Linde & Associates, Inc.

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PREFACE

This book is designed to present attitudes, skills, and the fundamental concepts of architectural drafting to persons who will benefit from this knowledge in their professional practice. Beyond skills and concepts, the authors hope to communicate to readers an understanding of state-of-the-art architectural drafting as a means of graphic communication. The professional architect or draftsman needs a clear and fluent command of the language of architectural drafting.

The Professional Handbook of Architectural Working Drawings is divided into three parts. Chapters 1 to 5 are designed to build what we have called "professional foundations" and provide basic information about drafting equipment, office procedures, and fundamental skills in addition to an understanding of the evolution of construction documents and methods of construction. Chapters 6 to 14 bridge the gap between theory and practice. These chapters demonstrate the preparation of site plans, foundation plans, floor plans, elevations, building sections, and other drawings. Throughout this section the ability to communicate general design concepts through specific working drawings is emphasized and reinforced. Chapters 15 to 18 present case studies that show the evolution of working drawings from the design concept through the finished construction documents for four different buildings: a beach house, a mountain cabin, a theatre, and an office complex. The four buildings make use of different building materials and systems. Simple wood, heavy timber, masonry, and steel and wood are the materials displayed in these case studies.

Regional differences, as they affect construction methods, are one of the most difficult subjects to address. We conducted a national survey to illustrate the diverse problems faced by different regions. The results of this survey are carefully summarized and included in this book. The case studies were also selected to show extreme conditions such as wind, rain, earthquake, and snow.

Appropriately, the illustration program in this book is its outstanding feature. Over 700 illustrations including photographs were created specifically for the book by its authors.

We would like to acknowledge the contributions of several people to this book—two in particular. **Marilyn Smith**, coordinator and administrative assistant, was responsible for all phases including manuscript preparation, correspondence, and reproduction to mention just a few. Her participation was invaluable. **Louis Toledo** was coordinator of all of the drafting phases of the book, including most freehand lettering and the establishment of the various stages of drawings as developed in the case studies. His supervision proved to be a major asset.

We also thank Vince Toyama for his participation in the drafting of the office building, the condominium project, and all freehand details and freehand sketches. Gregory Haddon, along with developing the drawings for the beach house, was responsible for all corrections and additions to the various drawings. He was also instrumental in the conceptual development of many of the sequential lessons. Nancy Wakita was responsible for much of the detailed and tedious coordination of reviews, checking drawings, indexing, and typing. We are grateful for her spiritual support as well. Mark Wakita's major responsibility was organizing the research questionnaire. Also among his duties was the organization of the reproduction drawings. William Boggs was responsible for scheduling and the aerial photography of the major structures in the book. Judy Joseph, our editor at Wiley, helped bring the book from proposal to reality. We are grateful for her professional attitudes and approach. We thank Jill Mellick for her excellent editing of the original and final manuscripts and Georgia Linde for her assistance in proofreading the manuscript at various stages.

Osamu A. Wakita
Richard M. Linde

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BASIC DRAFTING REQUIREMENTS



Kinds of Drafting Equipment

Basic Equipment

The drafting tools needed by a beginning drafts person and the basic uses of those tools are shown in Figure 1.1 and are as follows:

1. **T-square.** A straight edge used to draft horizontal lines and a base for the use of triangles.
2. **Triangle.** A three-sided guide used to draft vertical lines and angular lines in conjunction with a T-square. The 30°/60° and 45° triangles are basic equipment.
3. **Erasing shield.** A metal or plastic card with pre-punched slots and holes used to protect some portions of a drawing while erasing others.
4. **Eraser.** A rubber or synthetic material used to erase errors and correct drawings.
5. **Scale.** A measuring device calibrated in a variety of scales for ease of translating large objects into a small proportional drawing.
6. **Drafting tape.** Tape used to hold paper while drafting.
7. **Drafting pencil and lead holders.** Housing for drafting leads.
8. **Lead pointer.** A device used to sharpen the lead in a lead holder.
9. **Divider.** A device resembling a compass, used mainly for transferring measurements from one location to another.
10. **Compass.** A V-shaped device for drafting arcs and circles.
11. **French curve.** A pattern used to draft irregular arcs.
12. **Circle template.** A prepunched sheet of plastic

punched in various sizes, for use as a pattern for circles without using a compass.

13. **Plan template.** Prepunched patterns for shapes commonly found in architectural plans.
14. **Dusting brush.** A brush used to keep drafting surfaces clean and free of debris.

Additional Equipment

In addition to the tools listed above, a number of others aid and simplify the drafting process. They are shown in Figure 1.2.

1. **Track drafter.** A device that allows the drafting pencil to rest against the blade of the scale, and be held stationary while the whole track drafter is moved to draw (track) a line. Look at the track on the left side of the drafting table in Figure 1.2.
2. **Adjustable triangle.** A triangle used to draft odd angles such as those found in the pitch (slope) of a roof.
3. **Triangles of various sizes.** Triangles range in size from extremely small ones, used for detailing or lettering, to very large ones, used for dimension lines, perspectives, and so on.
4. **Lettering guide.** A device used for drafting guide-lines of varying heights.
5. **Flat scales.** The scales shown in Figure 1.2 are smaller than those shown in Figure 1.1 and are flat. They provide greater ease of handling, but they do not have as many different scales.
6. **Specialty templates.** Specialty templates include furniture, trees, electrical and mechanical equipment, geometric shapes, and standard symbols.

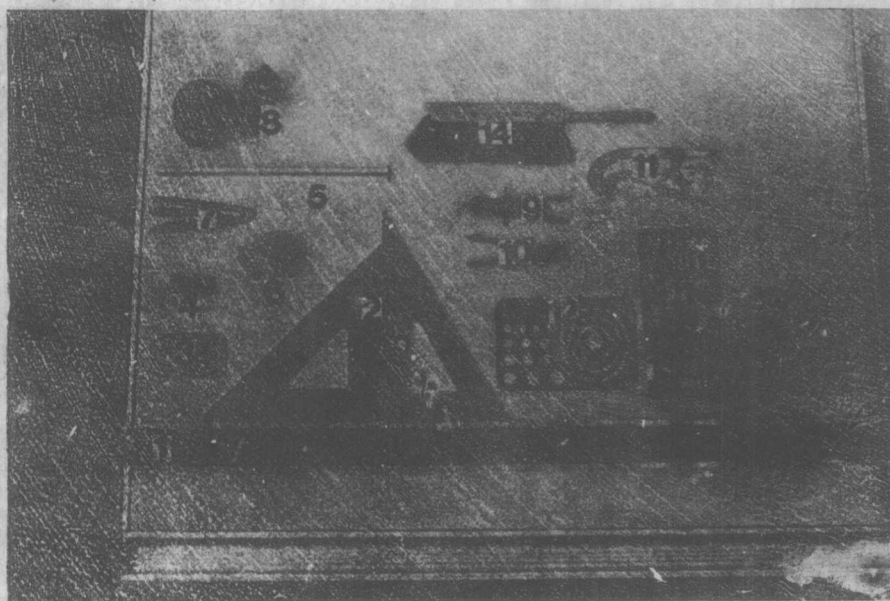


Figure 1.1 Basic drafting equipment.

7. **Proportional dividers.** Dividers used to enlarge or reduce a drawing to any proportion.
8. **Electric eraser.** Particularly useful when you are working with erasable sepias or ink.
9. **Parallel straightedge.** Shown in Figure 1.3, this device is often preferred over a T-square, because it always remains horizontal without the user's constantly checking for alignment. This straightedge runs along cords on both sides, which are mounted on the top or the underside of the drafting board. Parallel straightedges are available in lengths up to 72 inches.
10. **Drafting machine.** Shown in Figure 1.4, this machine uses a pair of scales attached on an arm. These scales move in a parallel fashion so parallel horizontal and vertical lines can be drawn. A protractor mechanism allows the drafter to rapidly move the scales to any desired angle. The drafting machine can be mounted onto a drafting board as shown in the illustration or on a drafting desk.

This list is by no means complete. Your selection of tools will be dictated by office standards and the requirements of particular projects.

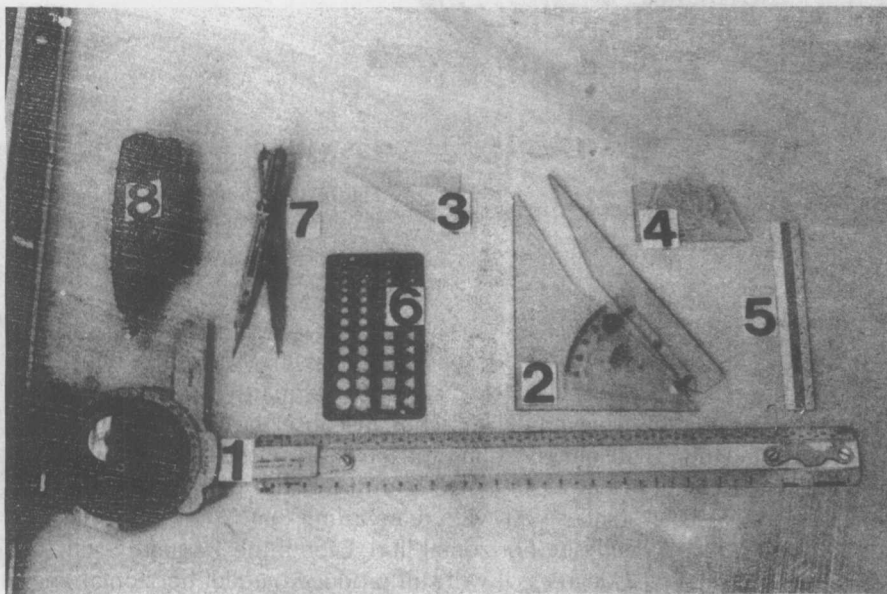


Figure 1.2 Additional drafting equipment.

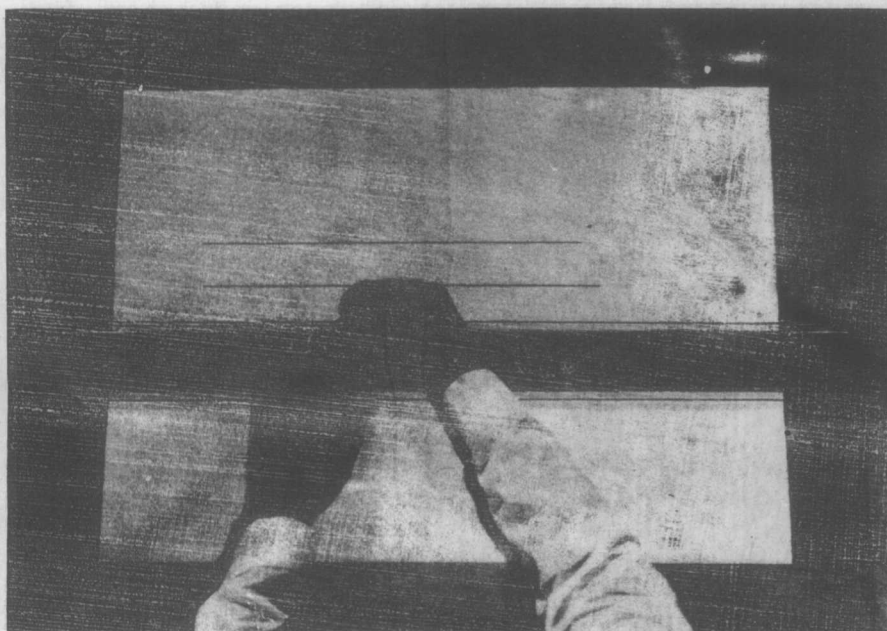


Figure 1.3 Parallel straightedge.
(Courtesy of Kratos/Keuffel & Esser.)

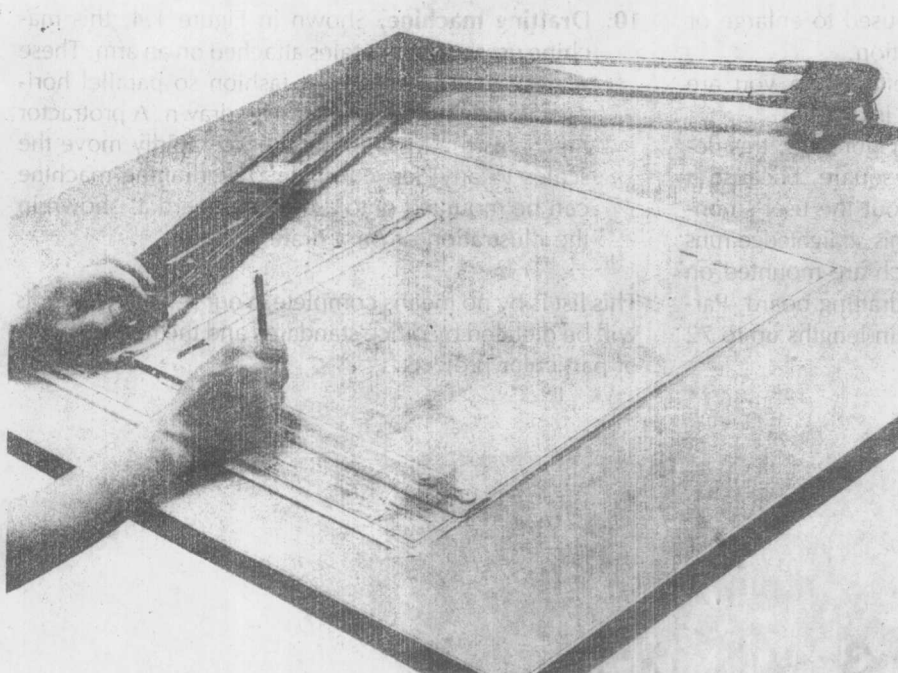


Figure 1.4 Drafting machine.
(Courtesy of Kratos/Keuffel & Esser.)

Using Drafting Equipment

Using the T-square

To use a T-square properly, you must have a true straight-edge along which to guide the T-square head. As you guide the head against the edge, keep pressure between the edge and the head of the T-square. See Figure 1.5. Notice that the right-handed person keeps pressure against

the blade portion while drawing horizontal lines. See Figure 1.6. Never use the T-square on a drafting board in a vertical direction because the board may not be absolutely square or the head of the T-square may not be at a 90° angle with the blade portion; in these instances you will create a line that is not perpendicular with the horizontal line. Even if the T-square is off, say 2 degrees, it will still produce parallel horizontal lines.

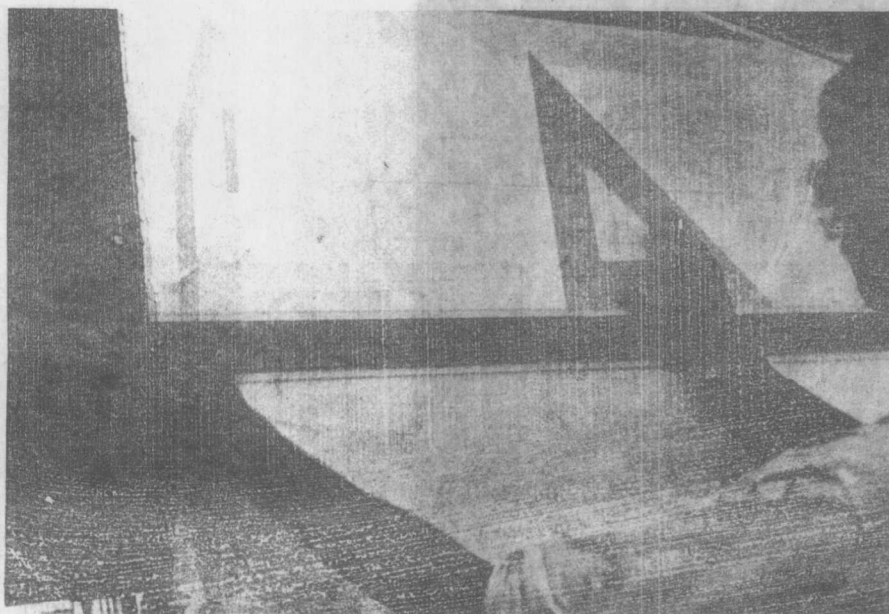


Figure 1.5 T-square and triangle.

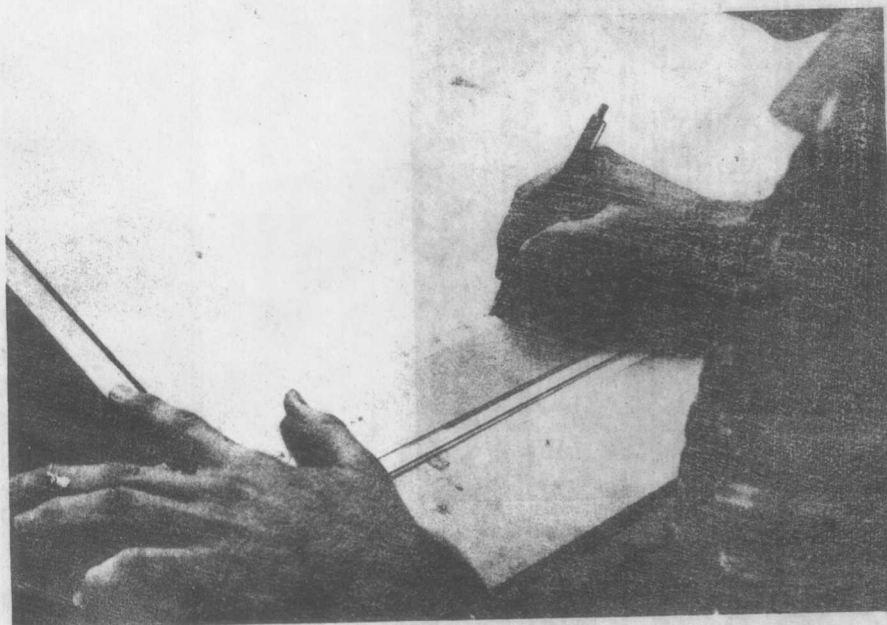


Figure 1.6 Drawing with a T-square.

Using the Triangle

The triangle is used in conjunction with the T-square to draft vertical lines and angular lines. See Figures 1.7 and 1.8. In both photographs, note how the drafts person holds down the T-square firmly with the left palm, and holds the triangles tight against the T-square with the fingers of the left hand, allowing freedom to draw the line with the right hand. You can use the 45° and the 30°/60° triangles in tandem with each other to obtain additional angles as shown in Figures 1.9 and 1.10. Used

correctly, triangles enable you to draw lines every 15°. Figure 1.9 shows how a 45° triangle is placed on a 30° triangle to achieve a 75° angle. A 30° triangle can also be placed on a 45° triangle to achieve the same result.

In Figure 1.10, a 45° triangle is used as a base, and correct placement of a 30°/60° triangle gives a 15° angle. To draw these angles in the opposite direction, simply flip both triangles over together.

Drawing Parallel Lines. To draw parallel lines, look at Figure 1.11 and follow these directions:

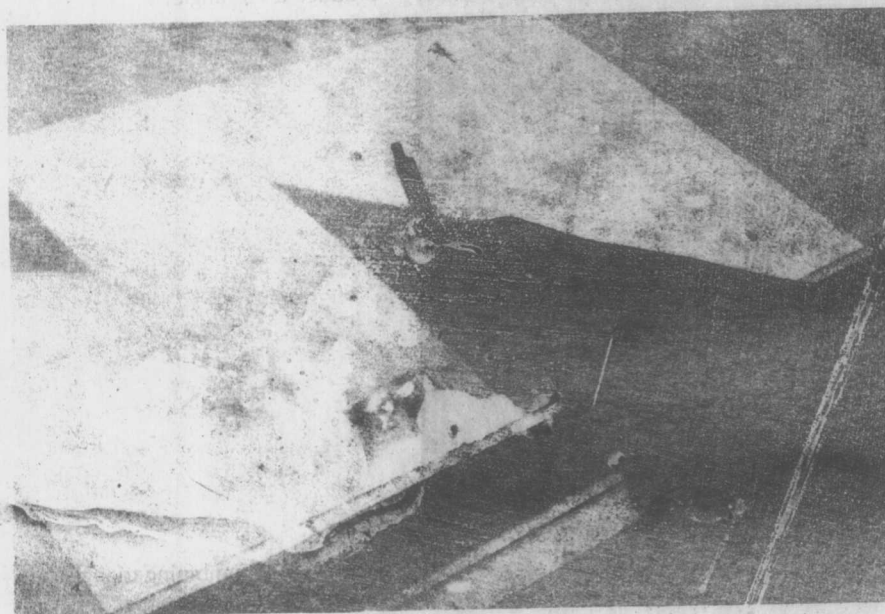


Figure 1.7 Correct use of a triangle for drawing 90° angles.

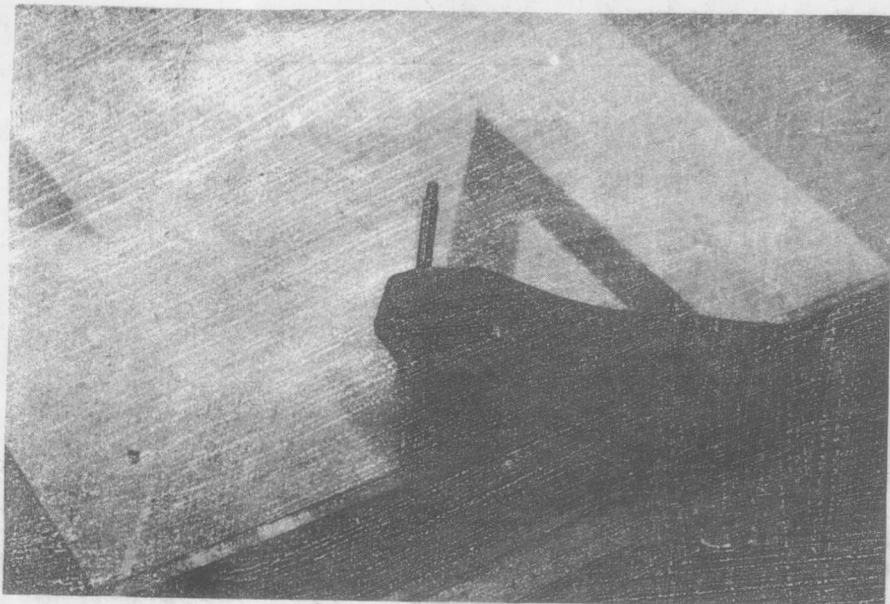


Figure 1.8 Using a triangle to draw an angle.

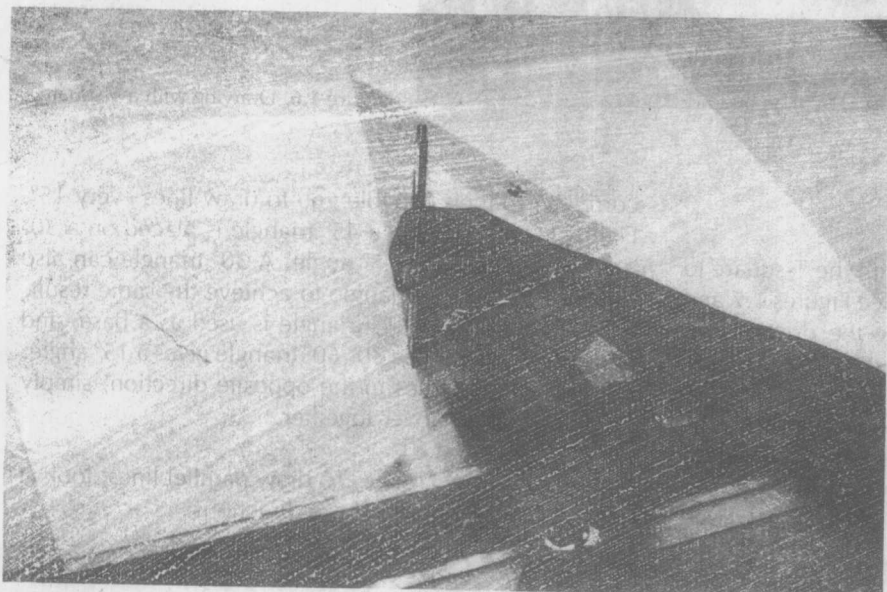


Figure 1.9 Combining triangles to produce a 75° angle.

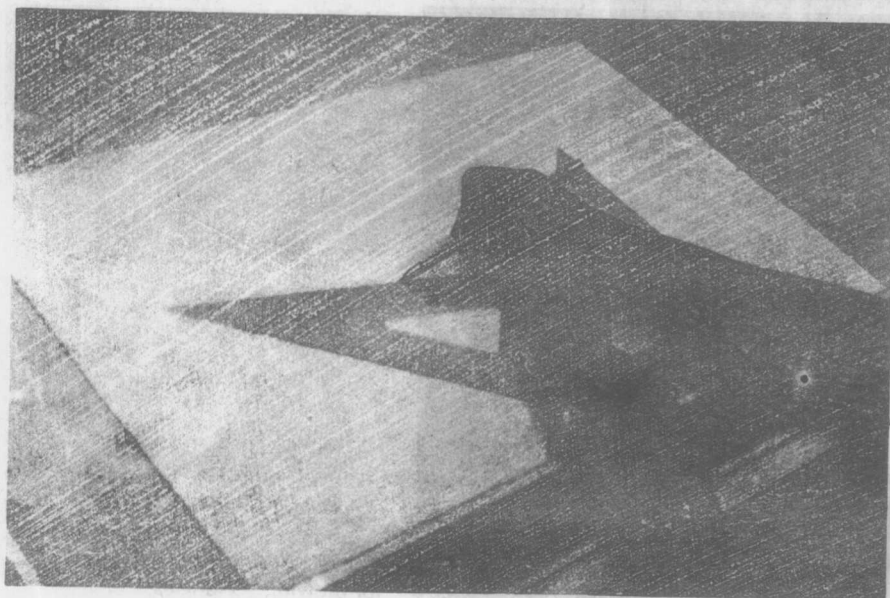


Figure 1.10 Combining triangles to produce a 15° angle.



Figure 1.11 Drawing parallel lines on an angle.

1. Place one of the triangles on top of a T-square (30° works well).
2. Move the triangle and the T-square together until they line up with the existing line.
3. Holding the T-square with one hand, slide the triangle away from the existing line.
4. As the triangle is moved, draw the parallel lines.
5. The procedure can also be done with two triangles.

Drawing Perpendicular Lines. The procedure for drawing perpendicular lines is illustrated in Figure 1.12 and is similar to the procedure for drawing parallel lines. However, after the triangle surface is aligned with the line, the triangle must be rotated clockwise, so that the 60° surface is against the T-square.

Using Erasing Shields and Erasers

Drawing Dotted Lines. Dotted lines, which are usually called **hidden lines** in drafting, can be drawn rapidly by using an erasing shield and an eraser. An electric eraser is more effective than a regular eraser.

First draw the lines as if it were a solid line, using the correct pressure to produce the desired darkness. Second, lay the erasing shield over the line so that the row of uniformly drilled holes on the shield aligns with the solid line. Next, erase through the small holes. The results will be a uniform and rapidly produced hidden (dotted) line.

This technique is particularly effective for foundation plans, which use many hidden lines. See Figure 1.13.

Using the Scale

The Triangle Scale. The most convenient scale to purchase is a triangular scale because it gives the greatest variety in one single instrument. There are usually 11 scales on a triangle scale, one of which is an ordinary 12-inch ruler. See Figure 1.14.

Reading the Scale. Since structures cannot be drawn full scale, the 12-inch ruler which is full scale is seldom used. Reading a scale is much the same as reading a regular ruler. Translating a full-size object into a reduced scale—1½ scale for example—is more a matter of your visual attitude than of translating from one scale to another. For example, you can simply imagine a 12-inch ruler reduced to 1½ inches in size and used to measure at this reduced scale. The scale is written on a drawing as $1\frac{1}{2}" = 1'-0"$. See Figure 1.15.

On an architectural scale, inches are measured to the left of the zero. Numbers are often printed here to indicate the inches to be measured. Note the 1½ standing by itself on the extreme left. The number explains the scale.

All 3 sides of the triangle scale (except the side with the 12-inch scale) have 2 scales on each usable surface. Each of these 2 scales uses the full length of the instrument, but one is read from left to right and the other from right to left. Typically, a scale is either one half or double the scale it is paired with. For example, if one end is a ¼-inch scale, the opposite end is a ½-inch scale; if one end is a ⅜-inch scale, the opposite end is a ¾-inch scale. The opposite end of the 3-inch scale would be the 1½-inch scale.