"Thus shadow owes its birth to light."—John Gay

13

Perspective Drawings, Shades and Shadows

It is of great advantage for the architectural drafter to be able to draw objects as they appear to the casual observer. A realistic representation is still the most effective way of showing a client, who may have a minimal knowledge of graphics, the appearance of a proposed structure. Through the years, architects have used perspectives in presentation drawings and also for preliminary planning sketches. Unquestionably, the value of perspective drawings is due to the fact that architectural designs are shown in the most natural way. Drafters with a working knowledge of perspective will be better prepared for presentation work and, equally important, will find themselves with a keener sense of 3-dimensional space visualization. To the beginner, perspective may seem difficult, but after careful study of the principles, even the novice with comparatively little experience will be able to do surprisingly well.

This chapter is not an exhaustive study of the theory of perspective; rather, it is meant to show the beginner the fundamentals and the methods commonly employed in drawing perspectives with the least difficulty and in the most practical way. We will concern ourselves mainly with the "how" rather than the "why" by the use of step-by-step illustrated instructions.

13.1 THEORY AND NOMENCLATURE

Perspective drawing is a pictorial method of representing a building or object, very much as the lens of a camera records an image on film. We can say that a perspective is the projection of an object on a fixed plane from a fixed point. Remember that a view we observe with our eyes is actually two coordinated views from two points, usually not fixed as we move our heads about, producing 3-dimensional realism difficult to obtain on a drawing. The drawing can only show the image as it will appear from one point of view, and of course, that point is fixed. This is a limitation inherent in every perspective drawing. Occasionally, even with the most accurate projection, an entirely unrealistic representation will result. For that reason, slight modifications of points and geometric arrangement in drawing may be necessary before arriving at a satisfactory picture. The student must be willing to make several trials, if need be, for the sake of appearance and true architectural proportions.

The basic theory of perspective drawing assumes that the image is produced upon a transparent vertical plane, called the "picture plane" (Fig. 13-1), very much as the orthographic views (discussed in Chapter 3) are formed on transparent planes—the only difference being that the orthographic have parallel projectors, whereas the perspective views have projectors radiating from a single point, similar to the visual rays of a person's eye (see Fig. 13-1). The outline of these projection points, as they pierce the picture plane, forms the perspective drawing. For comparison, we could produce a perspective on a window glass if we were looking through it at a building across the street and drew the exact outlines as we see them through the glass. On our paper, however, we will plot all the points of the perspective with projection lines from the orthographic plan and elevation view, thereby eliminating any guesswork. A pictorial representation of the planes and points necessary to draw a typical perspective is shown in Fig. 13-2. Later, we will discuss how each is laid out on paper to produce the finished perspective.

Down through the years, many artists and drafters have contributed to the system of perspective projection as we know it today. The accompanying woodcut, "Demonstration of Perspective," by Albrecht Dürer, is from the artist's treatise on geometry, written in 1525. It illustrates a rather crude yet effective early attempt to prove the principle of projectors forming a true image as they pierce a vertical plane (Fig. 13-3).

To interpret both the drawings and written material, we must have an acquaintance with perspective terms. It would be wise at this point to study

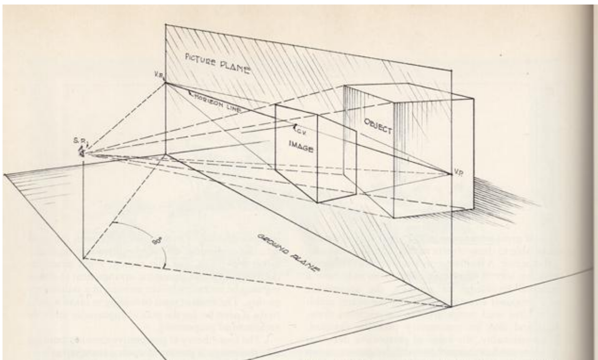


Figure 13-1 In perspective drawing, the image of an object is produced on a theoretical, transparent plane called the "picture plane" as we look through the plane at the object.

Figure 13-2 A 2-point perspective done by the office method.

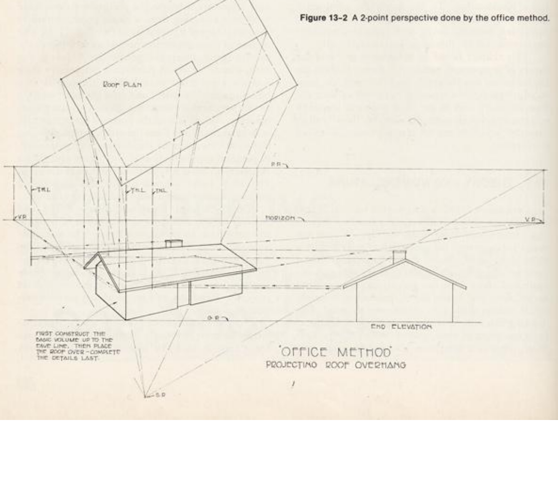


Figure 13-3 A woodcut by Albrecht Durer in 1525 verifying the principles of perspective. The string passing through the picture plane locates points to form the image.

the drawings in this chapter and observe the significance of each of the following terms:

Picture Plane (P.P.) As we mentioned, the picture plane is conveniently thought of as a transparent, vertical plane upon which the perspective is drawn. The lower edge of the plane intersects the ground plane. On the plan-portion view of the layout, it appears as a line parallel to the ground plane and usually is placed between the station point and the object (see Fig. 13-2). All horizontal measurements are established on the picture-plane line and are projected to the perspective. Any part of an object touching the picture plane will have true-height characteristics, and these heights can be projected directly from an elevation of the object or measured directly as long as the feature touches the picture plane. You will notice in the different drawings that the farther back from the picture plane the features fall, the smaller they will appear on the perspective. On the lower, elevation portion of our perspective construction layout, the surface of the paper becomes the picture plane. For convenience, we will label the picture-plane line P.P. on the drawings; the other terms will also be designated by their initial capital letters.

Ground Plane (G.P.) The ground plane must be horizontal and is represented with a line on the elevation portion of our layout. If the object touches the picture plane on the plan, it must also touch the groundline in a similar manner on the perspective (see Fig. 13-2). If the object is placed in back of the picture plane in plan, it will appear above and back of the groundline on the elevation. The groundline is always parallel to the horizon line and represents the intersection of the picture plane and the ground.

Station Point (S.P.) The station point is the origination of the visual rays as the object is observed through the picture plane. It will appear as a point on both the plan and elevation construction. However, it is usually not shown in elevation; yet it would fall on the horizon directly above its plan designation. The placement of the point on the plan view obviously determines the "view" of the building. And this choice of placement would be very much like actually walking around the building to determine the most favorable position for observation. (Generally, it is most expedient to choose the front view showing the entrance.) It also becomes evident that the distance between the station point and the picture plane directly affects the finished size of the perspective (see Fig. 13-7). If they are close together, the perspective will appear small; if they are farther apart, a larger perspective will result. In early attempts, students often make the mistake of placing the station point too near the picture plane. In general, the station point should be placed about twice as far away from the picture plane as the length of the building being drawn. Another method of determining the proper distance for a pleasing perspective is with the use of a 30° triangle. Merely place the triangle so that its sides enclose the extremities of the plan (Fig. 13-4), and the apex will locate a satisfactory station point. Usually, the point

Figure 13-4 A convenient method for locating the station point.

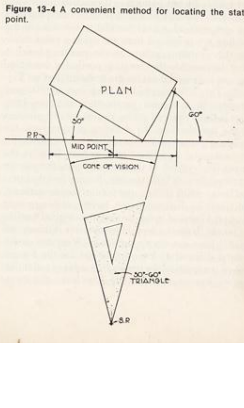


Figure 13-5 Photograph of a house with major lines extended to locate the vanishing points.

is located in the center of vision (see Fig. 13-7B), rather than off to one side. The most desirable placement of station points comes only after experience is gained in dealing with the correct appearances of the many architectural forms and features that are generally encountered.

Horizon Line (H.L.) The horizon line represents the intersection of the sky and the ground, and therefore is only represented on the elevation portion of the drawing. Usually, the horizon line is placed above the ground line; the amount above determines the height of observation, since the horizon plane is always at eye level. If a view from 30′ high were desired, for example, the 30′ would be scaled from the groundline to determine the placement of the horizon line.

Vanishing Points (V.P.) Vanishing points always fall on the horizon line. Receding, horizontal lines which are not parallel to the picture plane vanish at these points (see Fig. 13-5). On the plan portion, perpendicular lines parallel to the sides of the building are projected from the station point to locate the vanishing points on the picture plane; to bring the points to the elevation portion of the setup, they are projected down to the horizon line (see Fig. 13-2). This is the method for a 2-point, angular perspective. In a 1-point perspective, the vanishing point is simply placed in the most favorable position on the horizon line. In drawing perspectives, the vanishing points make convenient terminations for the horizontal receding lines, and as long as the proper lines vanish at the correct point, the picture will develop with little trouble. Remember that parallel lines vanish at the same point. Sloping surfaces, which will be discussed later, have vanishing points lying on a vertical trace through the original vanishing points. Unless a 3-point perspective is drawn, all vertical lines are drawn vertically. Very few architectural delineators have found use for the 3-point type of perspective. In reality, the sides of tall buildings would converge vertically as we look up at them. But the distortion does not lend itself to accurate presentation; therefore, we will not concern ourselves with 3-point perspective in this material.

Occasionally, when working on large drawings, the vanishing point falls a considerable distance from the paper. If a large board is not available to overcome this problem, some method must be employed to vanish lines at the distant points. Often an adjacent table can be used, and a thumbtack in the vanishing point will aid in aligning an especially long straight-edge. Another method is shown in Fig. 13-6 with the use of an offset-head T square and a curved template fastened to the board.

True-Height Line (T.H.L.) If a vertical line of the object touches the picture plane, the line will appear full length on the finished perspective, thus providing a convenient method for projecting true heights: from an elevation view or by measurement directly on the true-height line, if necessary (see Fig. 13-2). If difficulty is encountered in establishing heights for a certain feature of the floor plan with the use of only one true-height line, the problem can be solved by projecting the feature to the picture plane. Wherever the projection intersects the picture plane, a new true-height line can be drawn for measuring the height of that feature only. Remember that height measurements can be made on only those features that touch the picture plane.

13.2 PERSPECTIVE VARIABLES

Briefly, the variables in perspective construction, other than the actual scale change of the orthographic views, are the relationships between the station point, picture plane, and object (see Fig. 13-7). Naturally, there can be an infinite number of relationships, and the draftsman should know the various ways in which these variables can be manipulated for the most desirable pictorial appearance.

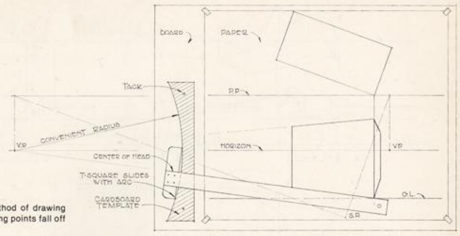


Figure 13-6 Handy method of drawing lines when their vanishing points fall off the drawing board.

The relationship of the object to the picture plane (Fig. 13-7). First of all, a decision must be made as to which sides of the building should appear on the perspective. Ordinarily, the front is shown and given the most emphasis; occasionally an interesting feature in the rear will call for a view from that side. Emphasis is attained by placing the important side at a small angle from the picture plane—the larger the angle, the less the emphasis. Usually, the 30°-60° angles are convenient for laying out the plan in relation to the picture plane, with the 30° angle given to the more important side. A 45° angle produces equal emphasis on the two observable sides of a building, thereby lessening the interesting effect that is achieved when only one side is emphasized.

It is worth remarking that without changing the scale of the orthographic views, the size of the finished perspective can be controlled to a certain extent by merely changing the forward and backward relationship of the plan and picture plane (Fig. 13-7G, H, and I). Usually the front corner of the plan is placed on the picture plane; but by bringing the plan *down,* with more of it (or all of it) in front of the picture plane, a larger perspective will result. Conversely, if a smaller perspective is desired, the plan can be placed in back of the picture plane. This variation obviously controls the size of the perspective slightly, if such becomes necessary.

The distance from the station point to the picture plane After observing the drawings, it will be seen that the closer the station point is to the picture plane, the smaller the perspective becomes. Also, close station points produce images with sharp angles on their forecorners, resulting in distorted and displeasing perspectives. On the other hand, if the station point is placed too far from the picture plane, it will usually fall off the paper and therefore become troublesome. Under ordinary conditions, a station point placed to produce a 30° angle of vision with respect to the extremities of the plan produces quite satisfactory images (see Fig. 13-4). The cone of vision should not be more than 45° in width.

The station point can also be moved to the right or left of the center of vision (Fig. 13-7A, B, and C), but its placement too far either way will produce distortion. Similar effects can be gained by changing the angle of the plan in relation to the picture plane, as previously mentioned. The latter method is advisable since it keeps the station point and the center of vision in a perpendicular relationship to the picture plane, eliminating unnecessary distortion.

The height of the horizon from the ground plane The placement of the horizon line in respect to the groundline determines the eye-level height in observing the building (see Fig. 13-8). The horizon is always at eye level. If it is placed above the height of the roof, a bird's-eye view will result; if it is placed below the foundation of the building, the perspective will give one the impression of looking up at the building from a low position, such as a valley. The normal position of the horizon is 5′-6″ or 6′-0″ above the groundline; this distance represents the eye-level height of the average person standing on level ground. Care should be taken not to place the horizon line at the same height as a dominant horizontal feature on the building, such as a strong roof line. The feature will then coincide with the horizon line and thereby lose much of its interest and im-

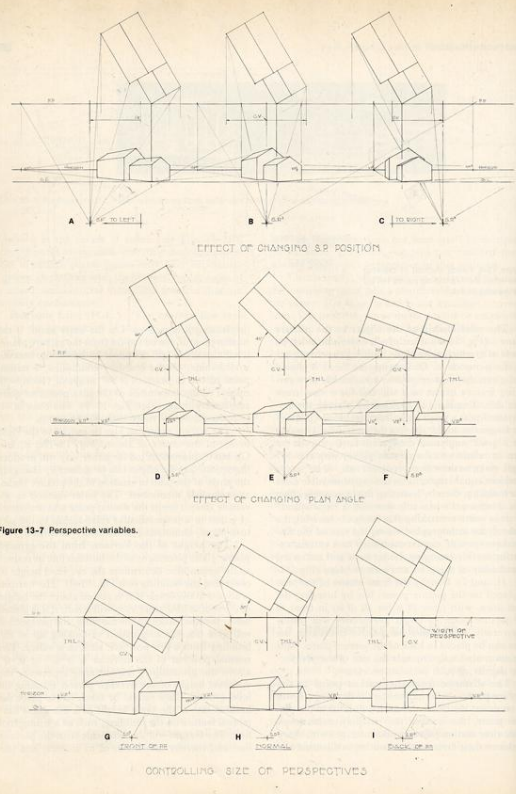


Figure 13-7 Perspective variables.

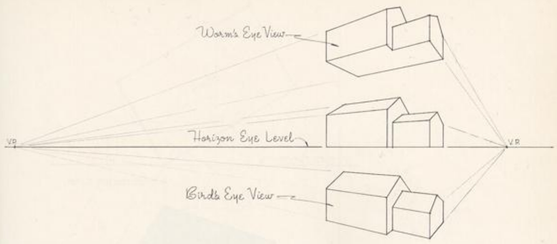


Figure 13-8 Effect of viewing a building from different heights.

portance. Low buildings, such as houses with flat roofs, are usually given more interest if the horizon line is placed 25′ or 30′ high. Although this placement gives prominence to the roof, it nevertheless reduces strong, nearly horizontal roof lines (see Fig. 13-9).

We see that the variables that exist in the setting up of a perspective layout make it possible for the drafter to adapt a mechanical projection method to a variety of perspective situations. With experience, the modifications can be made to give variety to the perspectives, which will be limited only by a drafter's reluctance to experiment and improve the quality of his work. Do not forget, however, that interest is important on a drawing, but not at the expense of misrepresenting true architectural conditions.

13.3 TYPES OF PERSPECTIVES

All linear perspectives (those defining outlines) used by delineators can be classified as either 2-point or 1-point perspectives (as we stated, 3-point perspective is not effective in architectural presentation). The 2-point angular perspective (Fig. 13-2) is the most popular type for showing the exteriors of buildings. Two sides of the building are seen, and the angular nature of these sides reveals the important information without excessive distortion. Several methods of construction have been developed—namely:

1. The common or office method;
2. The direct projection method; and
3. The perspective-plan method.

The office method is of particular importance to the beginner; it is widely used and most often the simplest method for orientation. Although more complex, the perspective-plan method has more versatility and drawings can be completed quicker once the principles have been mastered. The knowledge of these two methods will be sufficient for any perspective work encountered and will be discussed in what follows.

The 1-point perspective (Fig. 13-18) depicts a building or interior with one side parallel to the picture plane. It will be seen that the horizontal lines of the parallel side are drawn horizontally, producing a true orthographic shape of the side. The receding, parallel sides are formed by lines converging to a single point, the vanishing point, usually placed within the view. Interior views of rooms are often drawn with the 1-point method; it presents an accurate description of the facing wall, combined with observation of both receding sidewalls. Another typical application for 1-point perspective is a street flanked by buildings. Looking directly down the street, the vanishing point falls at the end of the street. The receding building and street lines are then conveniently drawn to the one vanishing point (see Fig. 13-19). Other dramatic applications can be found for the 1-point method, especially when formal architectural arrangements are involved. Many

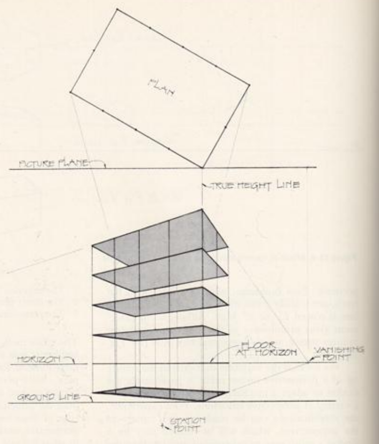


Figure 13-9 Appearance of floor levels at various heights.

of the principles of 2-point perspective apply equally to the 1-point, only minor variations in setting up the perspective change.

13.4 TO DRAW A TWO-POINT ANGULAR PERSPECTIVE OF AN EXTERIOR (OFFICE METHOD)

Figures 13–10 through 13–12 show the step-by-step sequence usually employed.

STEP A

1. Draw the floor plan, or roof plan as shown, on a 30°–60° relationship with the horizontal. Or a separate plan can be taped down in a similar position.
2. Draw the horizontal picture-plane line touching the lower corner of the plan. (Other relationships can be used later, if desired.)
3. Locate the center of vision (C.V.) midway on the horizontal width of the inclined plan.
4. Establish the station point on the center of vision, far enough from the picture plane to produce a 30° cone of vision (refer to Fig. 13–4).
5. From the station point, draw perpendicular projectors, parallel to the sides of the plan, to the picture plane. These points are the vanishing points in plan, and are often called distance points.
6. Draw a horizontal ground-plane line a convenient distance below the picture plane. It will need to be placed only far enough below the picture plane to allow sufficient space for the perspective layout.

STEP B

7. Draw the elevation view on the groundline. Place it off to the side of the perspective area; even if projection lines run through the elevation view, no harm will result. This view supplies the heights; therefore, it must be drawn to the same scale as the plan. Usu-

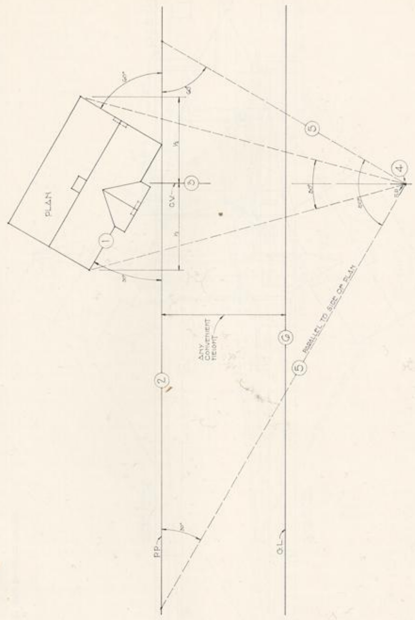


Figure 13-10 Step A in drawing a perspective by the office method.

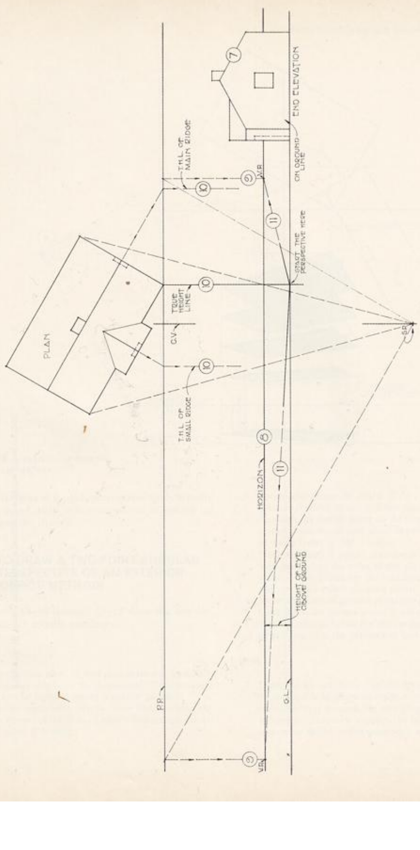


Figure 13-11 Step B—office method.

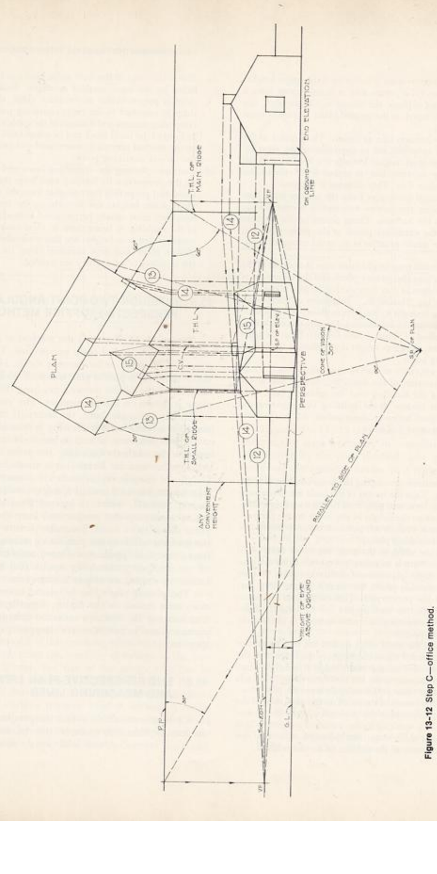


Figure 13-12 Step C—office method.

ally the end elevation is sufficient if the major heights are shown. (If a perspective is being drawn from a separate set of plans, the elevation, like the plan, can merely be taped on the ground plane in a convenient position.)

8. Draw the horizon line as shown. The heights of the elevation view will aid in determining the most effective eye-level height. Usually if a level view is desired, the horizon line is scaled 6'-0" above the ground-plane line. This distance is optional.
9. Drop vertical projectors from the picture-plane distance points (projectors originating at the station point) to the horizon. These points on the horizon line are the vanishing points of the perspective and should be made prominent to avoid mistaken identity.
10. Draw vertical true-height lines from the corner of the plan touching the picture plane and the extension of the two ridges as they intersect the picture plane. Unless they are "boxed in," ridgelines of gable roofs should be brought to the picture plane, where a true-height line can be established. Usually this is the simplest method of plotting their heights; from the true-height line, the ridge height is vanished to the proper vanishing point.
11. Now we are ready to start the perspective itself. From the intersection of the main true-height line at the corner of the building and the ground plane, construct the bottom of the building by projecting the point toward both vanishing points. All perspectives should start at this point.

STEP C

12. Next, continue developing the main blockmass of the building. Take the height of the basic block from the elevation view and project it to the true-height line. This gives us the height of the block on the perspective. Again, project this point on the true-height line to both vanishing points.
13. To find the width of the basic block, we must go to the plan. With a straightedge, project both extreme corners of the plan toward the station point. Where these projectors pierce the picture plane, drop verticals to the perspective. This establishes the basic-block width; the back corner can be located, if desired, by vanishing the outer corners to the correct vanishing points.
14. Next, plot the main ridge so that the roof shape can be completed. Project the height of the ridge from the elevation view to the main ridge true-height line. Vanish this point to the left vanishing point. The ends of the ridge must be taken again from the plan view. Project both ends of the ridge on the plan toward the station point; where the projectors pierce the picture plane, drop verticals to the vanished ridgeline. This defines the main ridge, and the edges of the roof can then be drawn to the corners of the main block.
15. The small ridge of the front gable roof can be established by the same method as above. Because this ridge is perpendicular to the main ridge, the small ridge is vanished to the right vanishing point. The remaining corners and features of the gable extension in front of the main block can be taken from the plan by the method previously mentioned and vanished to the correct vanishing point.
16. Continue plotting the remaining lines and features on the perspective by locating each from the plan as usual and projecting their heights from the elevation view. After heights are brought to the true-height line, they must usually be projected around the walls of the building to bring them to their position. Remember that true heights are first established on the picture plane and then vanished along the walls of the building to where they are needed.

13.5 INTERIOR TWO-POINT ANGULAR PERSPECTIVE (OFFICE METHOD)

Figure 13-13 illustrates the method of drawing an interior view with 2-point perspective. The principles are the same as for exterior views. However, notice that only a partial plan is drawn, and the rectangular shape of the interior touching the picture plane is drawn on the perspective. The view forms within this rectangle; later, the rectangle can be removed if a feathered-out drawing is desired.

A pole has been placed in the room merely to indicate the method of plotting any point in space; other points can be located in a similar manner. Heights of features on the walls are projected to the true-height line and carried along the walls to their correct position, which is located from the plan. When setting up the perspective, keep the station point about twice as far from the picture plane as the greatest width of the plan being drawn; this effects a desirable appearance. Coordinates can be laid off on the floor, resembling square tile, if odd locations or shapes are required within the room.

The picture plane can be placed in other positions than shown on the figure; regardless, projectors locating the features must be brought to the picture plane before they are dropped to the perspective.

13.6 THE PERSPECTIVE-PLAN METHOD AND MEASURING LINES

Comparison will show that the perspective-plan method requires less space on the drawing board, has more versatility, and is obviously more sophisticated than the office method. Many professional architectural delineators use the perspective-plan method exclusively. Although several new variations in procedure are encountered, the basic principles of the office method are still applicable.

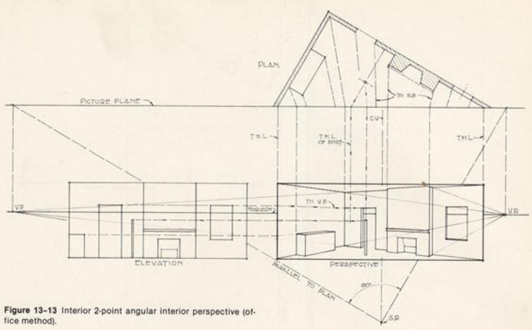


Figure 13-13 Interior 2-point angular interior perspective (office method).

The plan method requires no orthographic plan from which projections are taken. Rather, the perspective plan is drawn from measurements laid off on a horizontal measuring line. From this plan, vertical projectors establish widths and feature locations on the finished perspective. Heights are measured on a true-height line rather than projected.

It is usual practice to draw a perspective from a set of working drawings. The plot plan serves as a guide for correctly orienting the station point. The plan and elevation views furnish all the measurements for drawing the perspective. Here lies one of the advantages of this method; when transferring the dimensions from the working drawings to the perspective layout, the size of the perspective can be controlled by merely changing the scale of the dimensions during transfer. Also, the method allows trials of various horizon heights without a major amount of reconstruction. With the use of tracing paper over the original perspective plan, experimentation becomes a simple matter.

Figures 13-14, 13-15, and 13-16 illustrate the three major steps necessary in completing a simple perspective by the plan method. The given conditions and dimensions, similar to a typical problem, are shown in Fig. 13-14.

STEP A—LOCATING THE PRELIMINARY POINTS

1. Start with the horizon line and draw it near the upper part of the paper. For convenience, this line also serves as the picture plane in plan.
2. Establish the station point at the given distance on the center of vision (to scale) and draw the 30°-60° projectors to the picture plane. This locates the left and right vanishing points.
3. Construct the left and right measuring points (M.P.) on the picture plane. To locate the left measuring point, bring the distance between the left vanishing point and the station point to the picture plane with the use of an arc swung from the left vanishing point. From the right vanishing point, scribe the radius (right vanishing point to station point) to the picture plane; this point becomes the right measuring point. These measuring points will be vanishing points for the horizontal measurements we will use in our next step.
4. Draw the ground-plane line 6'-0" (scaled) below the horizon line. This establishes our eye level.

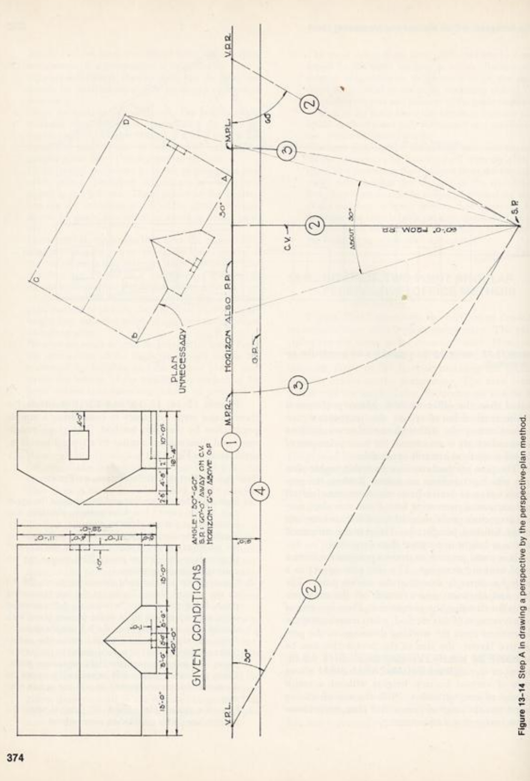


Figure 13-14 Step A in drawing a perspective by the perspective-plan method.

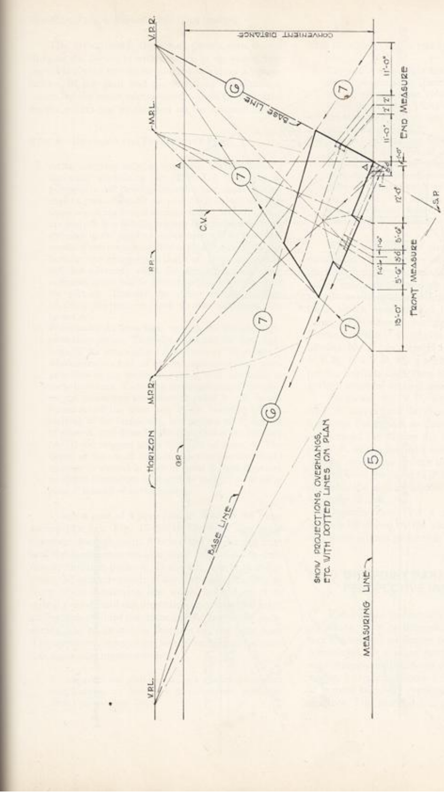


Figure 13-15 Step B—perspective-plan method.

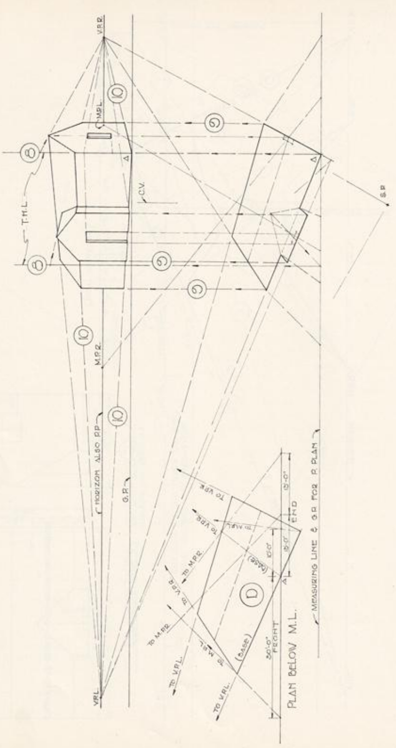


Figure 13-16 Step C—perspective-plan method.

The orthographic floor plan shown with dotted lines in the figure is unnecessary in an actual layout; it is added merely to give the beginner a visualization of the plan and picture-plane relationship, which, to the more experienced, would be indicated by the points just established on the horizon line.

STEP B—DRAWING THE PERSPECTIVE PLAN

5. At an arbitrary location below the horizon, draw a horizontal measuring line (H.M.L.). The plan in perspective will develop from this line, making it actually a groundline for the plan only, as well as a line upon which horizontal measurements of the building are laid off. It is helpful to know that projections from the plan to the finished perspective will be more accurate if the measuring line is placed well below the horizon; the exaggerated shape of the resulting plan will not adversely affect the perspective, and also, sufficient space will be gained for the development of the picture. Transfer the corner of the building touching the picture plane to the measuring line (point A).
6. From point A, draw lines to both the left and right vanishing points. These lines are the left and right edges of the plan and are referred to as "base lines." Measurements laid off on the measuring line, when projected to the measuring point, will terminate at these base lines. To lay out the dimensions of the plan on the measuring line, start at point A. All the dimensions of the front side of the building (A–B), starting at the forecorner, are stepped off to the left of point A, and those for the right end of the building (A–D) are stepped off to the right of point A. The depth of the small front-entrance projection would necessarily extend in front of point A, and therefore its depth measurement would be laid off *to the left of point A* instead of to the right.

When a part of a plan falls in front of the measuring line (see Fig. 13–16D), the base line must continue through point A below the measuring line; and the measurements also must be laid off in continuity through point A. If the left side is in reference, the measurements of the features extending in front of the measuring line would be laid off *to the right of point A*, and the projection line to the left measuring point would therefore extend below the measuring line to locate the features on the base line. The opposite construction would be needed for similar right-side measurements.

7. To complete the plan, draw lines toward the correct vanishing point from the foreshortened measurements on the base lines.

STEP C—COMPLETING THE FINISHED PERSPECTIVE

8. Lay out a true-height line, projected from point A on the picture plane. Establish the bottom of the line on the ground plane, which has been scaled 6'–0" below the horizon. This line represents the corner of the building on the picture plane, and all scale heights are measured upon it.
9. Transfer corners and features from the plan to the perspective with vertical projectors.
10. Project heights of the building to the vanishing points as discussed in the office-method construction. Complete the perspective as shown by first blocking in the major forms, then adding the projections, openings, and other minor features after the general shape is found to be satisfactory.

When a number of similar-sloped features are needed on a perspective, and the amount of slope or pitch is given, it may be advisable to locate the vanishing points of the sloping planes (see Fig. 13–17). Slope vanishing points must lie on traces (vertical lines) which pass through the vanishing points located for horizontal surfaces, V.P.L. and V.P.R. Notice that the V.P. for the 30° inclined roof plane, labeled No. 1, is located on the right trace *above* V.P.R. If a V.P. for a horizontal surface is located on the horizon line, then the V.P. for an inclined surface must be located *above* the horizon.

To locate the V.P. for slope No. 1, start at M.P.R. and lay out the given slope (30° in this case) from the horizontal as shown by the shaded area, and extend the line to the right trace. This locates the V.P. of the inclined roof. The V.P. for the declining roof plane on the back part of the house is located from the same M.P.R. and the slope is layed out *below* the horizon and extended to the right trace *below* the V.P.R.

Opposite slope V.P.s are located in a similar manner as shown by the shaded areas Nos. 3 and 4 and their related projection lines.

13.7 ONE-POINT PARALLEL PERSPECTIVE (OFFICE METHOD)

The 1-point perspective has several typical applications, such as interiors, street scenes, and exterior details of entrances or other special features. Sometimes the 1-point method is the only effective way to represent buildings of unusual shape. For example, a U-shaped house being observed toward the U is most faithfully represented with a 1-point perspective. This method is usually easier to draw than

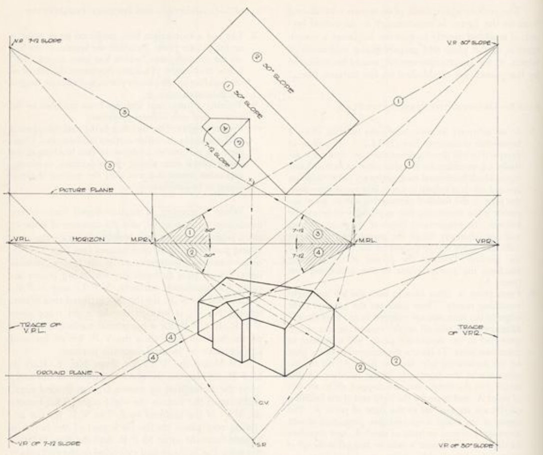


Figure 13-17 Vanishing points of slopes. Similar numbers indicate relative lines and angles.

the 2-point, angular perspective, and it is the only type that reveals three wall planes. All receding horizontal lines converge at only one vanishing point, and lines parallel to the picture plane in plan are parallel to the horizon in the perspective. Usually, less board space is needed.

Figure 13-18 shows a simple room interior drawn with the 1-point method. Notice that many of the perspective principles previously discussed are applicable. All the variations in respect to the placement of the picture plane, station point, and horizon equally affect the finished 1-point perspective drawing.

To construct a 1-point parallel perspective (Fig. 13–18), start by drawing the plan and elevation views as shown. Establish the picture plane at the lower part of the plan (it may be placed in front, in back, or at an intermediate area of the plan). On the center of vision below the plan, locate the station point, about the width of the plan away from the picture plane, or a 60° cone of vision in this case will satisfactorily locate the station point. The elevation view can be placed on either side of the area reserved for the perspective drawing. From the plan and elevation views, project the frame of the perspective representing the picture plane in elevation. Locate the one vanishing point within the frame at the desired distance above the groundline (bottom of frame). No horizon line is needed. If other than a room interior is to be drawn, start the perspective

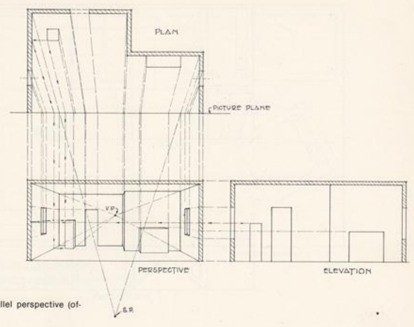


Figure 13-18 One-point parallel perspective (office method).

by drawing the features touching the picture plane; project their lines from both the plan and elevation views. Project interior wall lines toward the vanishing point. Locate the horizontal spacing of points and vertical lines by projecting the features from the plan toward the station point; at the intersection of the projectors and the picture plane, drop verticals to the perspective in the same manner as described in 2-point perspective (Section 13.4, Step C–13). Project heights from the elevation view to the true-height line. Notice how heights are carried along the walls, floors, or ceilings to where they are needed. Heights for objects away from the walls can be located by first establishing their heights on the nearest wall, then after projecting the objects horizontally to the same wall on the plan view, their heights and locations can be easily brought down to the perspective view. This procedure is indicated by the arrowheads on projectors from the tall box in the room.

The perspective-plan method can also be adapted to 1-point perspective construction, yet the office method is usually less time-consuming.

Figure 13–19 shows the construction of a simple *exterior* perspective using the 1-point method. Notice that the street lines converge at the vanishing point in the center of the drawing, and that the buildings have one wall parallel to the frontal picture plane.

When drawing 1-point perspectives of room interiors (frequently used by interior designers), the student often finds it difficult to place furniture in its desired position within the floor area. One method that will simplify the location of objects is with the use of grid lines (see Fig. 13–20). Notice that a scaled orthographic plan is first needed with the furniture layed out in its correct position. Convenient grid lines, similar in appearance to large, square floor tile, are lightly drawn on the plan and numbered consecutively if necessary both ways. The same grid lines are then drawn in perspective on the perspective drawing floor area.

Locate all the furniture outlines in perspective from the plan diagram using the correct grids for placement. Next, build up the heights of the furniture with measurements as previously mentioned to have correctly blocked-in forms. To complete the actual appearance of the furniture, add the details last.

13.8 A PROFESSIONAL METHOD OF DRAWING PERSPECTIVES

As we have already seen, setting up the perspective construction for the average building is rather time-consuming for the drafter. The profes-

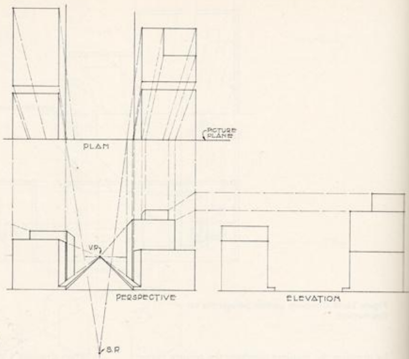


Figure 13-19 One-point parallel perspective (office method).

sional delineator, who is continually concerned with architectural perspective, must adopt a rapid yet versatile system that consistently produces satisfying and faithful drawings. One method having these characteristics combines the perspective-plan and measuring-point principles with a simple way of modifying and controlling the setup during construction. It begins with a pictorial plan of very small scale, drawn by the perspective-plan method, mainly for the purpose of early study before the finish perspective is started. This small, preliminary layout is called a "diagram," and is the secret of good perspectives without unnecessary, large-scale, trial-and-error construction. After a small diagram is perfected as to angle of observance, distance to station point, height of horizon, etc., only the necessary lines and points are enlarged to scale for the final perspective. Several drawings employing this system will convince the student that it is as effective in the classroom as it is in an architectural office. Follow the sequence of the numbers shown in the accompanying drawings and in the written instructions that follow:

Before beginning to draw, study the plot plan, if available, or proposed site arrangement. Determine which angle of observation will show the important elements of the building. Draw a line on the plot plan indicating the line of sight you have chosen. On this line, establish the station point by laying a 30° triangle on the line so that the angle represents the angle of vision. The apex of the 30° angle, as previously indicated, locates a satisfactory station point when the length across the building forms the length of the side opposite the 30° angle of the triangle. This point will help you visualize the tentative picture and orient you to the problem at hand. Study the elevation views, which will then be visible, and concern yourself only with them; if you are using a set of working drawings, lay the other drawings aside.

STEP A (Figs. 13-22 and 13-23)

1. Draw the horizon line as shown.
2. Construct a vertical center-of-vision line. It will also serve as a true-height line later.
3. Establish the station point on the center of vision by scaling the distance you indicated on the plot plan. Use a small scale. The civil engineer's scale can be used for enlargements of scale, if desired; it provides convenient multiples of ten.

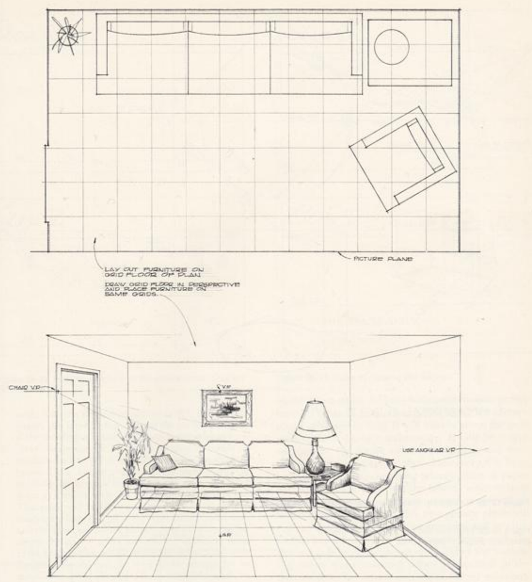


Figure 13-20 Using a floor grid field on a 1-point interior perspective to position furniture correctly.

4. Through the station point, draw a horizontal line—this will be the picture plane in plan, upon which all horizontal measurements of the building can be made. Occasionally, it may be necessary to construct an auxiliary picture plane for measuring; this will be discussed later.

STEP B (Fig. 13-23)

5. Locate the right and left vanishing points on the horizon line, by projecting from the station point as shown (if a 30°-60° angle of observance is satisfactory). Any angle can be used as long as the included

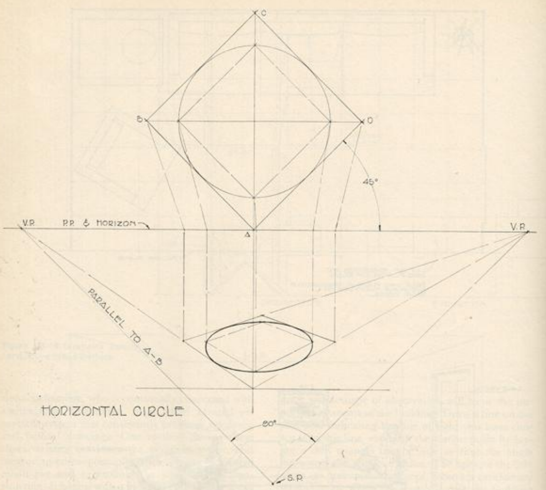
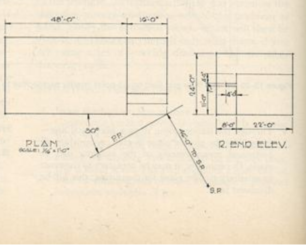


Figure 13-21 A method of drawing circular shapes in perspective.

Figure 13-22 Floor plan and end-elevation for the professional "diagram" perspective.



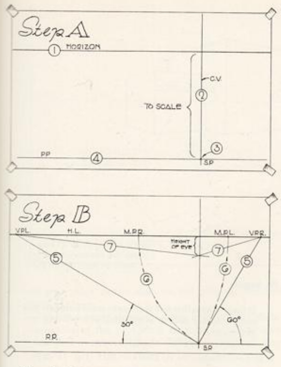


Figure 13-23 Preliminary steps for the professional "diagram" perspective.

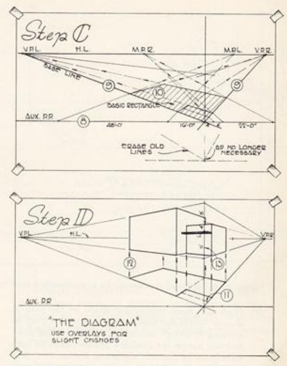


Figure 13-24 Steps in drawing the diagram.

angle between the two projectors is 90°. (These projectors can serve as base lines of the perspective plan if the drawing is small and space is not critical.)

6. Next, locate the left and right measuring points on the horizon line. With a compass, swing the distance between the station point and the right vanishing point to the horizon line, using the right vanishing point as a center, to locate the right measuring point. This point will be the vanishing point of all parallel measuring lines laid off to the right station point. Follow the same procedure for bringing the distance between the station point and the left vanishing point to the horizon line and locate the left measuring point.
7. Establish the desired eye level of the perspective by measuring down (in scale) from the horizon on the center of vision, to locate the corner of the building on grade. From this point, construct lines to both the left and right vanishing points. These lines become the base legs of our basic rectangle in perspective.

STEP C (Fig. 13-24)

In this step it may be advisable to construct a new picture plane in order to keep the drawing lower on the paper when working with larger buildings and scales. On small preliminary diagrams, the picture plane indicated in Step B will usually serve the purpose without being cumbersome. It will be found satisfactory for laying off measurements and constructing the perspective plan. However, if a large building is drawn, requiring a large piece of paper and considerable space on the board, when enlarging the diagram, an auxiliary picture plane will be found more convenient. This new picture plane will replace the original for measurements and is arbitrarily placed between the station point and the ground corner of the perspective. After the vanishing points and measuring points are located on the horizon line, the station point is no longer necessary and can be removed.

8. Draw the auxiliary picture plane, as shown.
9. Draw the new baselines from the intersection of the picture plane and the center of vision to both vanishing points. Use the original vanishing points and extend the lines below the auxiliary picture plane to take care of overhangs and offsets of the plan that occasionally fall outside the basic rectangle.

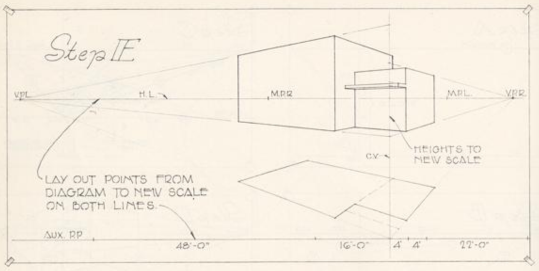


Figure 13-25 Laying out the perspective at a convenient scale from the diagram.

10. Draw the basic rectangular shape of the plan as shown. Notice that measurements are taken from the working drawings, converted to the working scale, and laid out on the auxiliary picture plane, on both sides from the center of vision (see Section 13.6, Step B). Project right-side measurements to the right measuring point and left-side measurements to the left measuring point. When they *intersect the baseline,* vanish them toward the corresponding vanishing point.

STEP D (Fig. 13-24)

11. Lay off measurements and construct all projections, overhangs, and roof lines if necessary. Intersections of sloping roofs will be needed to complete the perspective on gable and hip roofs. To avoid confusion later, when projecting the plan up to eye-level, roof intersections, overhangs, exterior stoops, etc., should be drawn as broken lines on the plan.
12. Project all visible corners from the plan up to the perspective. This final step is generally done on a separate tracing paper *overlay*—only the perspective will then be on the clean sheet. All construction is made from points under the overlay. Of course, preliminary diagrams are done on the original sheet for study, when only general shapes are necessary.
13. Take heights from the working drawings and convert to scale. Lay off the heights on the center of vision starting at ground level. The center of vision is on the elevation picture plane and therefore can be used for true-height measurements. If necessary, project heights around the walls of the building to where they are needed, as explained in previous methods. Block in basic shapes first and then make measurements and project details last, to avoid confusion between numerous lines.

STEP E—ENLARGING TO DESIRED SIZE (Fig. 13-25)

After several diagrams are studied and one is found to be satisfactory, a larger perspective can easily be constructed at the desired size. Merely lay out the horizon line and transfer the center of vision and all points from the diagram to a new scale. The size of the finished perspective can be controlled by the scale selected; for example, if the finished perspective is to be four times the size of the diagram, use a scale four times as large as the diagram for the new measurements along the horizon line, center of vision, and auxiliary picture plane.

At larger scales, horizontal measurements for constructing the plan will occasionally fall beyond the paper. To overcome this difficulty, follow the procedure shown in Fig. 13-26. Draw a horizontal line to the edge of the paper from a point on the base line where the longest measurement has been made. Make the additional measurement from the center of vision, and instead of projecting toward the measuring point, project to the vanishing point on the same side of the center of vision until it intersects the horizontal line. From this point it is treated as previously shown in Step C. The construction merely brings the dimension back in perspective to the point of maximum measurement and lays it off

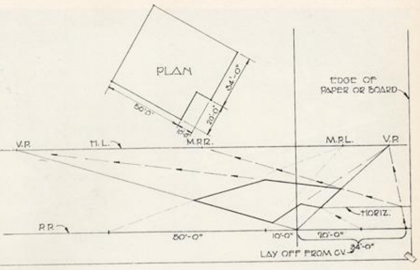


Figure 13-26 A method of making measurements that are too long for the drawing board.

on that plane rather than on the original forward picture plane.

After several drawings have been made, slight variations of the procedure may be found to save time and overcome minor difficulties, should they arise.

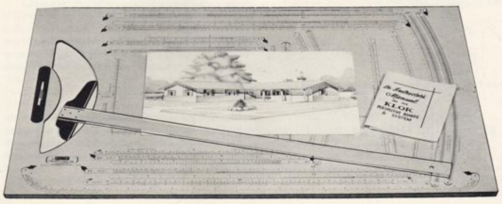
13.9 TIMESAVING SUGGESTIONS

The Diagonal Use diagonals of rectangular areas for quickly locating centers and for checking construction of the perspective as it develops.

Similar Perspectives If a number of similar perspectives are to be drawn, use perspective grid charts as an underlay. Various charts are available at drafting supply stores. Or, use a perspective board as shown in Fig. 13-28.

Reflections When showing the reflections of buildings in water or on other shiny surfaces, draw the reflections to the same vanishing point as the building. The water's edge is the dividing line between the reflections and the true images. Locate a reflected point as far below the shiny surface as the point is above (see Fig. 13-29).

Figure 13-27 The Klok Perspective Board. A timesaving device for drawing similar perspectives using scales and a modified T square as shown.



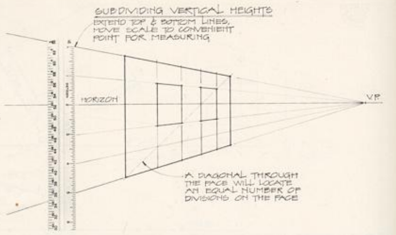


Figure 13-28 Subdividing perspective spaces.

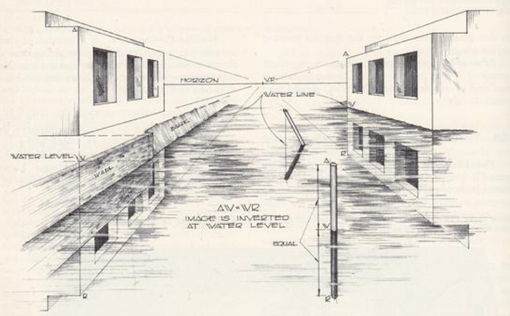


Figure 13-29 Reflections on water or other shiny surfaces can be quickly projected with the use of points as shown.

13.10 SHADES AND SHADOWS

The geometric forms of light and shade produced by the action of the sun on architectural subjects are of particular interest to the architect and the drafter. Good architectural forms have the property of producing pleasing shadows regardless of the sun's position. To the observer, shadows are an integral part of an architectural composition, and their representation becomes almost as important as the building itself.

Linear perspective, as we mentioned earlier, produces only the outlines of objects. Realism is at-

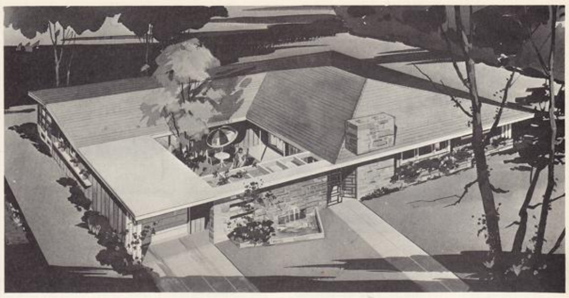


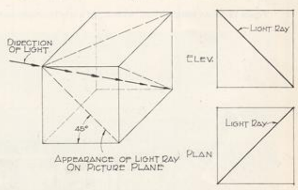
Figure 13-30 A perspective rendering showing the use of shadows to reveal important architectural features.

tained not by outlines, but by the sensitive selection of values of light and shade as well as texture to represent various surfaces. The effect of light upon surfaces and materials produces the true image; often outlines are almost entirely obscure. The study of shades and shadows is a further step in creating graphic realism. First the student must understand the action of light, then he must define it geometrically as it creates various patterns. These areas or patterns are then given the correct value or tone, in keeping with composition, contrast, and visual interest, to produce the desired pictorial effect.

On actual renderings, shadows can be overdone; if they are too mechanical and hard, much of their 3-dimensional expression is lost. The uniformity of the shades and shadows on the illustrations in this material is for the introduction of principles only and should not be taken as the correct representation of shadow values. Other finished perspectives (see Fig. 13-30) should be observed for displaying this quality. It will be seen that shades and shadows of finished work seldom have uniform tones throughout; in fact, the interplay of reflected light usually produces a graduation of tone. Shadows on architectural subjects are generally most prominent close to the observer, near the center of interest, and those farther away from the center of interest become more neutral and indefinite as they recede. Contrast and intensity of shadows near the observer, then, should be given the most consideration by the draftsman.

The Light Source Usually, on elevation-view shadowing, the light source is considered to be coming from the upper left. The conventional method illustrating a light-ray direction is by showing it passing through a cube diagonally, from upper left to lower right (see Fig. 13-31). Notice that it appears as a 45° line on both elevations and plan and can be easily drawn with the triangle. Another advan-

Figure 13-31 Conventional light source on orthographic views.



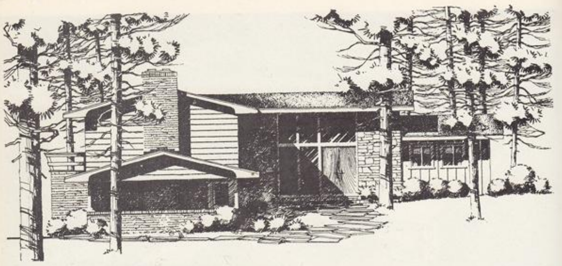


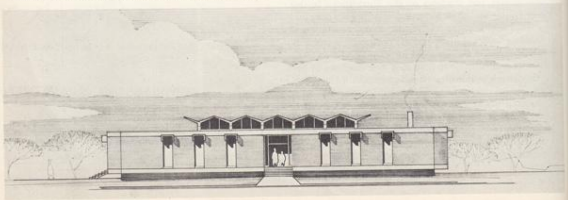
Figure 13-32 An elevation rendering showing the use of shadows.

tage of using the conventional 45° light source is that it conveniently reveals depth-dimensional characteristics. Shadows will fall to the right and below the object. The shadow of a point will be the same distance below as it is to the right of the original point. Therefore, the shadow clearly indicates the depth of recessed features. By its convenience for transferring distances from the horizontal to the vertical, and vice versa, the 45° triangle actually serves as a handy tool for measuring when plotting shadows. However, if a different shadow effect is desired, the 30°–60° triangle can also be used. In casting shadows, light rays are assumed to be parallel.

Orthographic Shadows As an introduction to the characteristics of shades and shadows, it would seem logical to begin with shadows produced on orthographic views. One might ask, "Why learn to put shadows on orthographic views, which are commonly used only for working drawings?" It is true that orthographic views are mainly for working drawings, and that they show depth information by association with related orthographic views. Yet many architectural offices have found that front elevations of buildings (as well as other elevations), if skillfully applied with texture indications and shadows, make very adequate and often very attractive presentation drawings (see Figs. 13–32 and 13–33). Such drawings are used to show clients the tentative appearance of a building. The greatest advantage of shadowed elevations over perspectives is the tremendous saving in preparation time, and time and cost are usually important.

At the very outset, we can say that the casting of shadows is affected by three conditions:

Figure 13-33 An elevation-view rendering of a small commercial building showing the use of shadows.



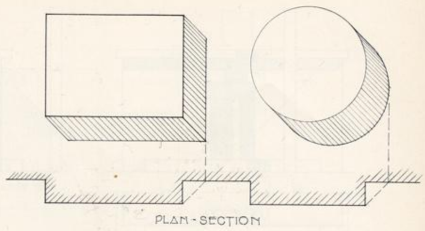


Figure 13-34 Plotting shadows of simple forms in orthographic views.

1. The direction of the light source;
2. The shape of the object; and
3. The manner and shape of the surface upon which the shadow falls.

In analyzing the action of light, the student is encouraged to observe the shadows of buildings and different objects about him in everyday life—even those of models in an artificial light source; the importance of astute observation of actual shadows cannot be overemphasized. After observing actual shadows and studying the accompanying shadow drawings, a number of *consistencies* become obvious. A few general ones are listed below and should be remembered:

1. Only an object in light casts a shadow;
2. A shadow is revealed only when it falls on a lighted surface;
3. The shadow of a point must lie on the light ray through that point;
4. On parallel surfaces, a shadow is parallel to the line that casts it;
5. The shadow of a plane figure will be identical to the outline of the figure if the shadow falls on a plane parallel to the outline of the figure; and
6. The shadow of a line perpendicular to the picture plane will be inclined if it falls on a surface parallel to the picture plane.

In plotting orthographic shadows, usually two views are necessary for the projection (see Figs. 13–34 through 13–39). Sometimes it may be a plan and an elevation, other times it may be two elevations. The important view is the one having the surface that receives the majority of shadows appear as

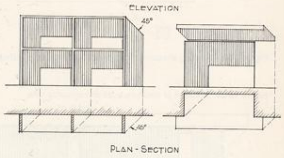
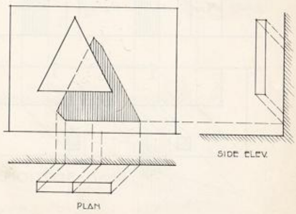


Figure 13-35 Plotting shadows to show relief in orthographic views.

Figure 13-36 Plotting shadows on removed surfaces in orthographic views.



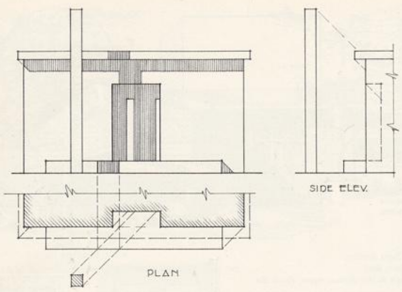
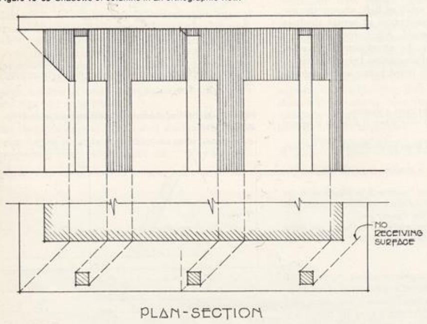


Figure 13-37 Plotting shadows on architectural features in orthographic views.

Figure 13-38 Shadows of columns in an orthographic view.



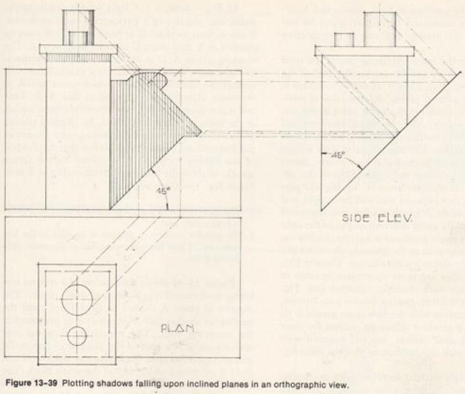
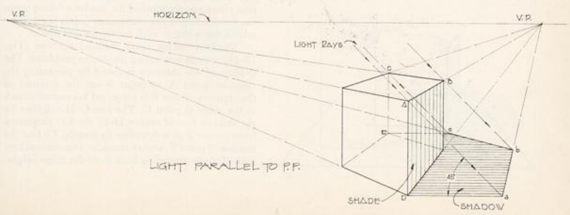


Figure 13-39 Plotting shadows falling upon inclined planes in an orthographic view.

a line. Plot each point or corner casting a shadow and complete the one shadow profile before going to the next. Check the resulting shadow to be sure each point is accounted for. If the result does not appear logical to the eye, the construction is usually faulty.

Perspective Shades and Shadows Similar principles to those we found in orthographic shadow casting are encountered in plotting shadows of pictorial subjects. On perspective drawings, often entire surfaces are on the opposite side from the light source and therefore receive no light. These surfaces must be shown in darker tones; yet they are not shadows. We refer to the darker surfaces of the object not receiving light as "shades" (see Fig. 13–40).

Figure 13-40 Perspective shadows falling upon a horizontal plane.

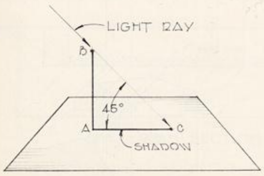


Determining the outlines of both shades and shadows (as well as occasional highlights) plays an important part in giving realism to perspective drawings.

Notice that the same vanishing points are used for both the shadows and the horizontal lines of the perspective itself (Fig. 13-40). If the light source is parallel to the picture plane, the shadows of horizontal lines will vanish at the same point as the object lines themselves. Also, the shadows of vertical lines will appear as horizontal shadows if they fall on a horizontal surface. Plotting shadows with a light source parallel to the picture plane, of course, limits shadow casting to either the right or left of the object, never in an oblique manner. In angular perspective, then, one exposed wall will be in light and one will be in shade. Various shadow characteristics can be obtained by using different angles of the light source. A high angle produces a narrow shadow on a horizontal plane such as the ground, whereas a low angle of light produces a wide shadow. Usually 45°, 60°, or 30° angles are most convenient because of the construction with drafting triangles (see Fig. 13-41). For the student, casting shadows on 2-point, angular perspectives with the *light source parallel to the picture plane* will produce adequate realism for most situations. For that reason, we will concern ourselves mainly with this method of shadow construction.

Actually, light striking an object such as a building that is drawn in an angular position, produces rather interesting and revealing shadows when the light source is parallel to the picture plane. The shadows from overhangs, offsets, and other features can be made to contribute effective composition elements to the finished drawing.

Figure 13-41 On perspective drawings, a light source parallel to the picture plane is convenient for casting shadows.



In Fig. 13-40, a 45° light source produces the shade and shadow of a perspective cube as shown. Point A casts its shadow at point a, point B casts its shadow at b, and point C casts its shadow at c. The shadow of line A–D is drawn horizontal, inasmuch as the shadow falls on a horizontal plane. Line A–B creates the shadow line a–b, which must vanish at the same right vanishing point as line A–B. Line b–c is the shadow of B–C and therefore must vanish at the same left vanishing point. By plotting points, and then the lines connecting these points, the entire shadow outline is completed. Notice that the shadow of the hidden corner C–E is plotted on the figure merely to show the horizontal relationship of E to c. From Fig. 13-40 we see that:

1. The shadow cast by a vertical line on a horizontal plane is horizontal; and
2. On parallel surfaces, a shadow is parallel to the line that cast it, and therefore vanishes at the same vanishing point.

Figure 13-42 shows the shadow of a vertical line being interrupted by a vertical wall plane. The shadow of point A cannot be established until the horizontal shadow line from point E is projected to the receiving wall. The remaining diagonal line above point a is a part of the shadow of line A–D, and is completed after the horizontal shadow of line A–D is projected on the top of the small block (line x–y). Line a–x–y is the shadow of A–D falling on perpendicular surfaces. From Fig. 13-42 we see that:

1. The shadow of a vertical line is vertical if it falls on a vertical surface; and
2. The shadow of a horizontal line is inclined if it falls on a vertical surface.

We see in Fig. 13-43 the effects of a horizontal shadow cast upon various levels of a simple stairs. The shadow is located on each level, vanished to the right vanishing point, and the shadows on the vertical risers merely connect the shadows falling upon the treads. Notice the convenient points used to establish the width of each horizontal shadow.

Shadows falling upon inclined surfaces (Fig. 13-44) present interesting projection problems. The shadow of the chimney is found by projecting the ridge at point A to point B on the forepart of the chimney. Point B is projected horizontally back to the ridge at point C. The line C–D will then be the shadow line of corner D–E; the 45° projection from corner E to e describes its length. To find the shadow of point F, we can consider a theoretical horizontal plane extending back from the ridge height.

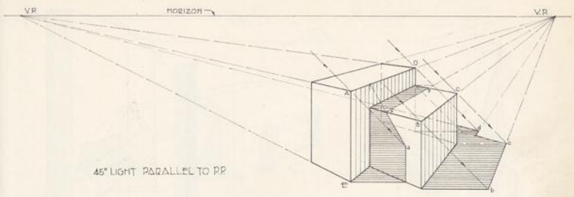


Figure 13-42 Perspective shadows falling upon a vertical plane.

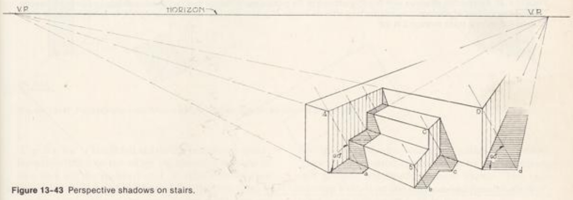
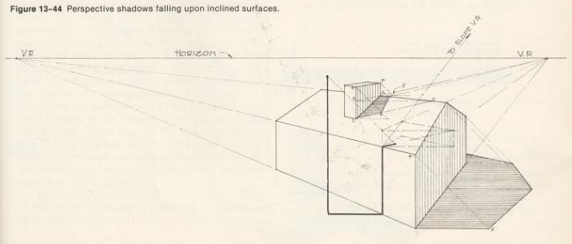


Figure 13-43 Perspective shadows on stairs.

Figure 13-44 Perspective shadows falling upon inclined surfaces.



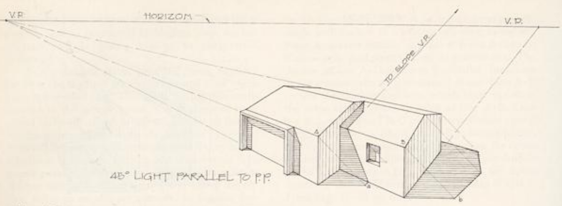
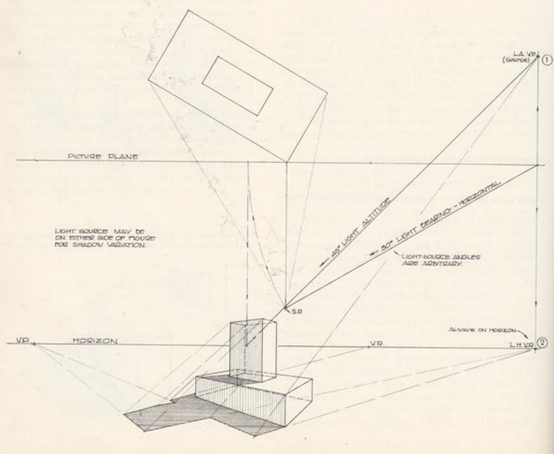


Figure 13-45 Various shadows showing the characteristics of buildings.

Figure 13-46 Perspective shadows with the light oblique to the picture plane. Notice that two shadow vanishing points are needed. They can be located at random or by bearing and altitude angles of a light source. The light-bearing V.P. is on the horizon and the altitude V.P. is on a trace through L.H.V.P.



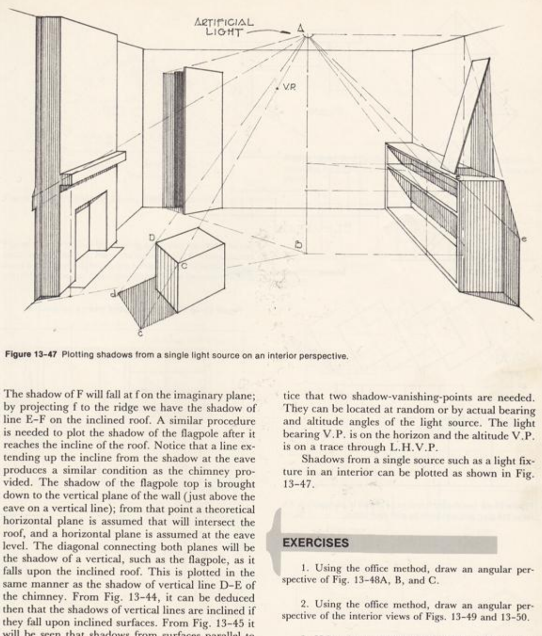


Figure 13-47 Plotting shadows from a single light source on an interior perspective.

The shadow of F will fall at f on the imaginary plane; by projecting f to the ridge we have the shadow of line E–F on the inclined roof. A similar procedure is needed to plot the shadow of the flagpole after it reaches the incline of the roof. Notice that a line extending up the incline from the shadow at the eave produces a similar condition as the chimney provided. The shadow of the flagpole top is brought down to the vertical plane of the wall (just above the eave on a vertical line); from that point a theoretical horizontal plane is assumed that will intersect the roof, and a horizontal plane is assumed at the eave level. The diagonal connecting both planes will be the shadow of a vertical, such as the flagpole, as it falls upon the inclined roof. This is plotted in the same manner as the shadow of vertical line D–E of the chimney. From Fig. 13-44, it can be deduced then that the shadows of vertical lines are inclined if they fall upon inclined surfaces. From Fig. 13-45 it will be seen that shadows from surfaces parallel to an incline will be parallel to the inclines.

Perspective shadows with the light source *oblique* to the picture plane can be projected if an actual exterior light condition is desired (see Fig. 13-46). Notice that two shadow-vanishing-points are needed. They can be located at random or by actual bearing and altitude angles of the light source. The light bearing V.P. is on the horizon and the altitude V.P. is on a trace through L.H.V.P.

Shadows from a single source such as a light fixture in an interior can be plotted as shown in Fig. 13-47.

EXERCISES

1. Using the office method, draw an angular perspective of Fig. 13-48A, B, and C.

2. Using the office method, draw an angular perspective of the interior views of Figs. 13-49 and 13-50.

3. Using the perspective-plan method, draw an angular perspective of Figs. 13-51, 13-52A–D, and 13-53.

4. Using the 1-point perspective method, draw a parallel perspective of Figs. 13-54 and 13-49A.