1

Reading Construction Drawings

1.1 INTRODUCTION

Construction drawings are necessary in most spheres of the building industry, as being the best means of conveying detailed and often complex information from the designer to all those concerned with the job. Building tradespeople, especially carpenters and joiners, should be familiar with the basic principles involved in understanding and reading drawings correctly. Mistakes on either side – in design or interpretation of the design – can be costly, as drawings form a legal part of the contract between architect/client and builder. This applies even on small jobs, where only goodwill may suffer; for this reason, if a non-contractual drawing or sketch is supplied, it should be kept for a period of time after completion of the job, in case any queries should arise.

1.1.1 Retention of Drawings or Sketches

A simple sketch supplied by a client in good faith to a builder or joinery shop for the production of a replacement casement-type window, is shown in Figure 1.1(a). The client’s mistake in measuring between plastered reveals is illustrated in Figure 1.1(b). Retention of the sketch protects the firm from the possibility of the client’s wrongful accusation.

Another important rule is to study the whole drawing carefully and be reasonably familiar with the details before starting work.

The details given in this chapter are based on the recommendations laid down by the British Standards Institution, in their latest available publications entitled Construction drawing practice, BS 1192: Part 1: 1984, and BS 1192: Part 3: 1987. BS 1192: Part 5: 1990, which is not referred to here, is a guide for the structuring of computer graphic information.
1.1.2 Scales Used on Drawings

Parts of metric scale rules, graduated in millimetres, are illustrated in Figure 1.2. Each scale represents a ratio of given units (millimetres) to one unit (one millimetre). Common scales are 1:100, 1:50, 1:20, 1:10, 1:5 and 1:1 (full size). For example, scale 1:5 = one-fifth (\(\frac{1}{5}\)) full size, or 1 mm on the drawing equals 5 mm in reality.

Although a scale rule is useful when reading drawings, because of the dimensional instability of paper, preference should always be given to written dimensions found on the drawing.

1.1.3 Correct Expressions of Dimensions

The abbreviated expression, or unit symbol, for metres is a small letter m, and letters mm for millimetres. Symbols are not finalized by a full stop and do not use a letter ‘s’ for the plural. Confusion occurs when, for example, \(3\frac{1}{2}\) metres is written as 3.500 mm – which means, by virtue of the decimal point in relation to the unit symbol, 3\(\frac{1}{2}\) millimetres! To express \(3\frac{1}{2}\) metres, it should have been written as 3.500 mm, 3.50 m, or 3.500 m. Either one symbol or the other should be used throughout on drawings; they should not be mixed. Normally, whole numbers should indicate millimetres, and decimalized numbers, to three places of decimals, should indicate metres. Contrary to what is taught in schools, the construction industry in the UK does not use centimetres. All references to measurement are made in millimetres and/or metres, i.e. 2 cm should be expressed as 20 mm.

1.1.4 Sequence of Dimensioning

The recommended dimensioning sequence is illustrated in Figure 1.3. Length should always be given first, width second and thickness third, for example 900 × 200 × 25 mm. However, if a different sequence is used, it should be consistent throughout.

1.1.5 Dimension Lines and Figures

A dimension line with open arrowheads for basic/modular (unfinished) distances, spaces or components is indicated in Figure 1.4(a). Figure 1.4(b) indicates the more common, preferred dimension lines, with solid arrowheads, for general use in finished work sizes.

All dimension figures should be written above and along the line; figures on vertical lines should be written, as shown, to be read from the right-hand side.

1.1.6 Special-purpose Lines

Figure 1.5: Section lines seen on drawings indicate imaginary cutting planes, at a particular point through the drawn object, to be exposed to view. The view is called the section and is lettered A–A, B–B and so on, according to the number of sections to be exposed. It is important to bear in mind that the arrows indicate the direction of view to be seen on a separate section drawing.
1.2 ORTHOGRAPHIC PROJECTION

1.2.1 Introduction
Orthography is a Latin/Greek-derived word meaning ‘correct spelling’ or ‘writing’. In technical drawing it is used to mean ‘correct drawing’; orthographic projection, therefore, refers to a conventional drawing method used to display the three-dimensional views (length, width and height) of objects or arrangements as they will be seen on one plane – namely the drawing surface.

The recommended methods are known as first-angle (or European) projection for construction drawings, and third-angle (or American) projection for engineering drawings.

1.2.2 First-angle Projection
The box in Figure 1.9(a) is used here as a means of explaining first-angle projection (F.A.P.). If you can imagine the object shown in Figure 1.9(b) to be suspended in the box, with enough room left for you to walk around it, then by looking squarely at the object from all sides and from above, the views seen would be the ones shown on the surfaces in the background.

1.2.3 Opening the Topless Box
In Figure 1.9(c) the topless box is opened out to give the views as you saw them in the box and as they should be laid out on a drawing. Figure 1.9(d) shows the BS symbol recommended for display on drawings to indicate that first-angle projection (F.A.P.) has been used.

Note that when views are separated onto different drawings, becoming unrelated orthographically, descriptive captions should be used such as ‘plan’, ‘front elevation’, ‘side elevation’, etc.
Figure 1.9 (a) Theory of first-angle orthographic projection (SE = side elevation, FE = front elevation, RE = rear elevation, R/H = right-hand side, L/H = left-hand side)

Figure 1.9 (b) Example object

Figure 1.9 (c) First-angle projection

Figure 1.9 (d) F.A.P. symbol

Figure 1.9 (e) Third-angle projection
1.2.4 Third-angle Projection
This is shown in Figure 1.9(e) for comparison only. This time the box has a top instead of a bottom; the views from the front and rear would be shown on the surface in the background, as before, but the views seen on the sides would be turned around and seen on the surfaces in the foreground; the view from above (plan) would be turned and seen on the surface above. Figure 1.9(f) shows the BS symbol for third-angle projection (T.A.P.).

1.2.5 Pictorial Projections
*Figure 1.10:* Another form of orthographic projection produces what is known as pictorial projections, which preserve the three-dimensional view of the object. Such views have a limited value in the make-up of actual working drawings, but serve well graphically to illustrate technical notes and explanations.

1.2.6 Isometric Projection
This is probably the most popular pictorial projection used, because of the balanced, three-dimensional effect. Isometric projections consist of vertical lines and base lines drawn at 30°, as shown in Figure 1.10(a). The length, width and height of an object thus drawn are to true scale, expressed as the ratio 1:1:1.

1.3 OBLOIQUE PROJECTIONS
There are three variations of oblique projections.

1.3.1 Cavalier Projection
Shown in Figure 1.10(b) with front (F) drawn true to shape, and side (S) elevations and plan (P) drawn at 45°, to a ratio of 1:1:1. Drawn true to scale by this method, the object tends to look mis-shapen.

1.3.2 Cabinet Projection
Shown in Figure 1.10(c), this is similar to cavalier except that the side and plan projections are only drawn to half scale, i.e. to a ratio of 1:1:2, making the object look more natural.

1.3.3 Planometric Projection
Shown in Figure 1.10(d), this has the plan drawn true to shape, instead of the front view. This comprises verticals, lines on the front at 30° and lines on the side elevation at 60°. It is often wrongly referred to as axonometric.

1.3.4 Perspective Projections
*Figure 1.11:* Parallel perspective, shown in Figure 1.11(a) refers to objects drawn to diminish in depth to a vanishing point.

Angular perspective, shown in Figure 1.11(b) refers to an object whose elevations are drawn to diminish to two vanishing points. This is of no value in pure technical drawing.
1.3.5 Graphical Symbols and Representation

Figure 1.12: Illustrated here are a selection of graphical symbols and representations used on building drawings.

Figure 1.13: On more detailed drawings, various materials and elements are identified by such sectional representation as shown here.

To help reduce the amount of written information on working drawings, abbreviations are often used. A selection are shown here:

- BMA = bronze metal antique
- DPC = damp-proof course
- DPM = damp-proof membrane
- EML = expanded metal lathing
- par = planed all round
- PVA = polyvinyl acetate
- T&G = tongue and groove
- bdg = boarding
- bldg = building
- cpd = cupboard
- hbd = hardboard
- hwd = hardwood
- ms = mild steel
- swd = softwood

1.3.6 Window Indication

Figure 1.14: Windows shown on elevational drawings usually display indications as to whether a window is fixed (meaning without any opening window or vent)
1.3.7 Door Indication

Figures 1.15 and 1.16: Doors shown on plan-view drawings are usually shown as a single line with an arrowed arc indicating their opening-direction, as illustrated. Alternatively, the 90° arrowed arc may be replaced by a 45° diagonal line, from the door-jamb's edge to the door's leading edge. Figure 1.16 is the indication for revolving doors.

1.3.8 Block Plans

Figure 1.17: Block plans shown on construction drawings, usually taken from Ordinance Survey maps, are to identify the site (e.g., No. 1 Woodman Road, as illustrated) and to locate the outline of the building in relation to its surroundings.

1.3.9 Site Plans

Figure 1.18: Site plans locate the position of buildings in relation to setting-out points, means of access, and the general layout of the site; they also give information on services and drainage, etc.

1.3.10 Location Drawings

These are usually drawn to a scale of 1:50 and are used to portray the basic, general construction of buildings. Other, more detailed, drawings cover all other aspects.