

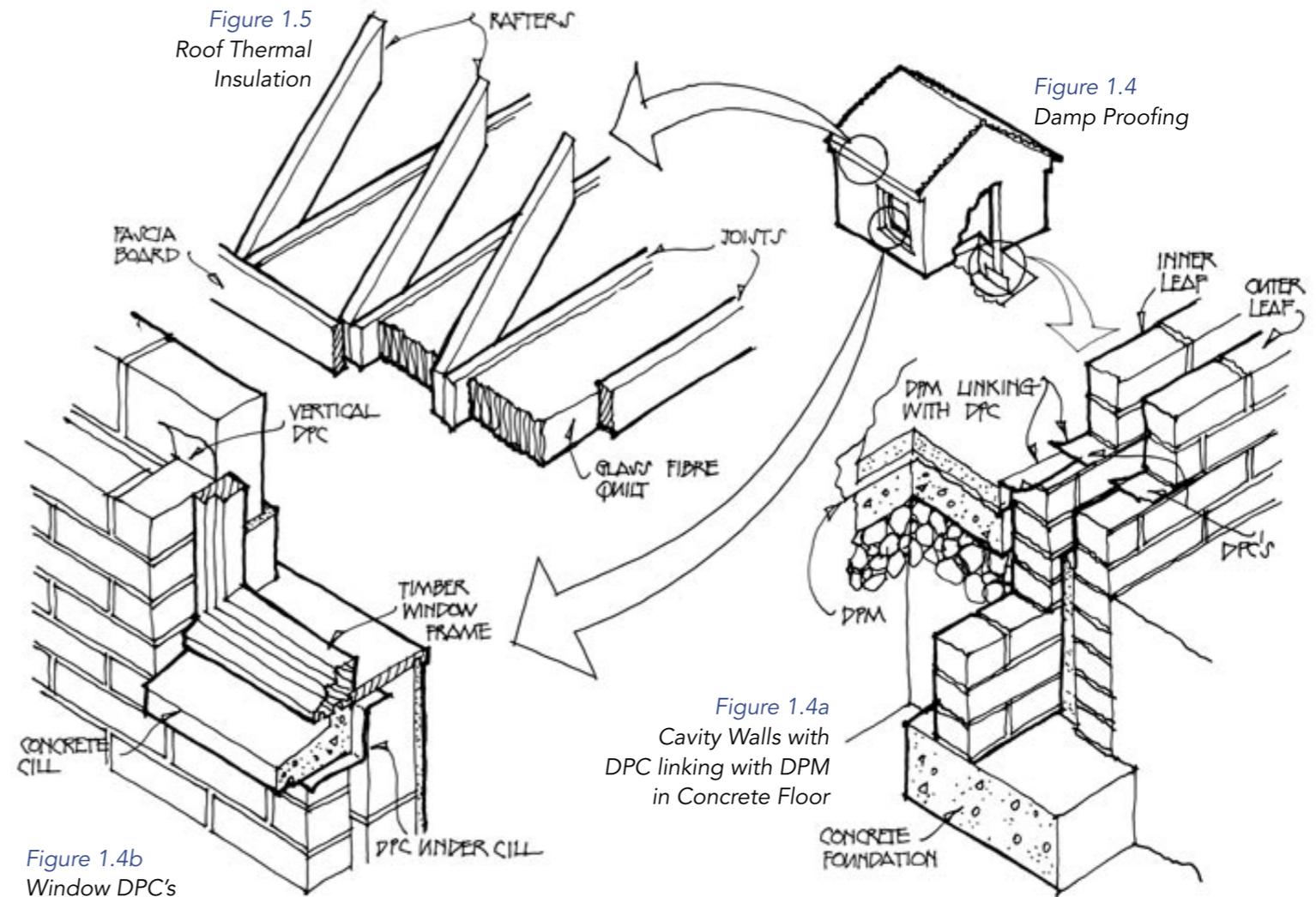
bottom, to ensure no penetration of rain. Other tiles have grooves set in their sides that interlock with the adjacent tile (see Figure 1.2c).

**Flexible Sheet Materials** The most common of these roofing finishes is built-up bitumen felt (Figure 1.2d). This is produced in 1 metre wide rolls and is laid on the roof, usually in three layers, each bonded to the other with hot bitumen. Water penetration is avoided by placing alternate layers at right angles, and overlapping adjacent sheets.

**Monolithic Materials** Mastic asphalt is a mixture of aggregate (stone granules) and bitumen (a tar-like substance). The material comes to the building site in blocks where it is heated up to form a liquid that is applied in two layers to a total thickness of 20mm (¾").

#### Rainwater Drainage

A great deal of rainwater falls on a roof, and this needs to be effectively collected and discharged. Because of this, 'flat' roofs are actually built 'to a fall' (incline) of 2° or so. At the lower end of the fall a gutter is required to collect the rainwater. The gutter itself is laid to a fall and at its lower end a downpipe is connected which takes the rainwater from roof to ground level. Here the water falls into a gully (a drainage fitting incorporating a 'U' bend) and is then discharged into the drain. Figure 1.3 shows a typical gutter and downpipe arrangement.



**External Walls**

**External walls** may be either 'load-bearing' or 'non-load-bearing'. Load-bearing walls are comparatively thick and heavy in order to support the loads of the roof, floors and contents of the building. Thin, lightweight non-load-bearing walls can be used in framed buildings since the major loads are supported by the stanchions of the framework.

**Curtain Walls** are a form of non-load-bearing external walling that forms a lightweight skin surrounding a structural framework. It consists of a lightweight framework (usually of aluminium alloy) into which are fitted glazed or opaque panels. *Figure 2.5* illustrates such a system comprising 'mullions' (vertical members) which are attached to the floor, or beams supporting the floor of

the building; 'transoms' (horizontal members) which fit between, and are attached to, the mullions; solid panels comprising a water-resistant outer layer, an inner layer which forms the internal surface of the wall, insulative infill and a 'vapour barrier' which prevents the passage of water vapour into the panel; and glazed panels.

Curtain walls form an immense impervious barrier that is particularly exposed to the effects of wind and rain. Special features are necessary to ensure that water does not penetrate into the building: the panels fit into the transoms and mullions by use of 'neoprene' (a synthetic rubber) gaskets which tightly seal the panels; and water

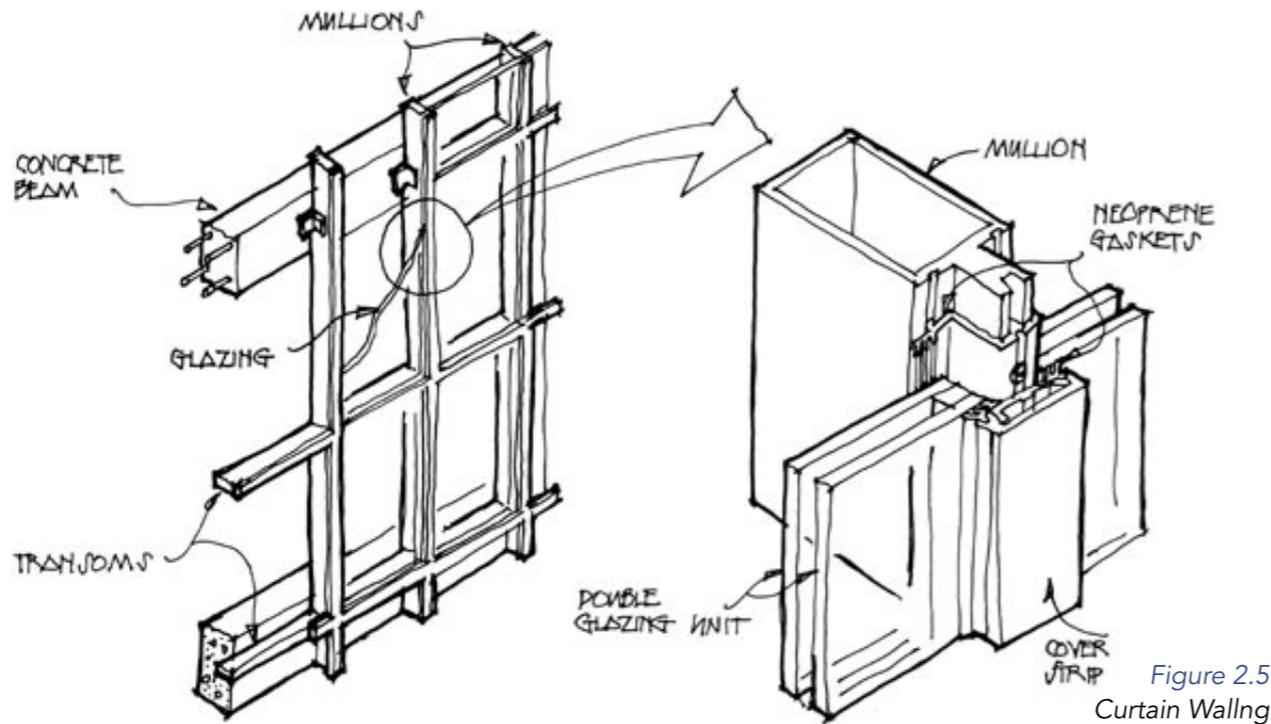


Figure 2.5  
Curtain Walling

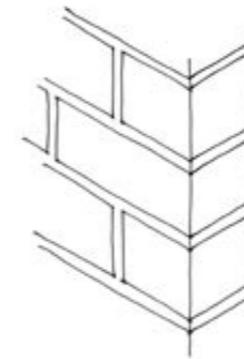


Figure 2.6a  
Flush Joint

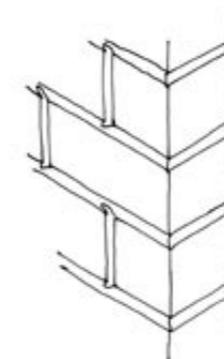


Figure 2.6b  
Ironed Joint

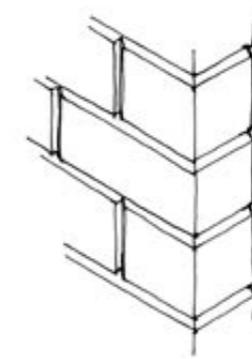


Figure 2.6c  
Weatherstruck Joint

Figure 2.6 Brick Joints

Figure 4.15 illustrates a slated eaves detail using head nailed slates. Note that at the bottom of the slating two courses of slates are necessary to prevent the ingress of rainwater, and that ventilators are set in the fascia board to ensure a free flow of air within the roof space over the insulation.

Figure 4.15 Slated Eave

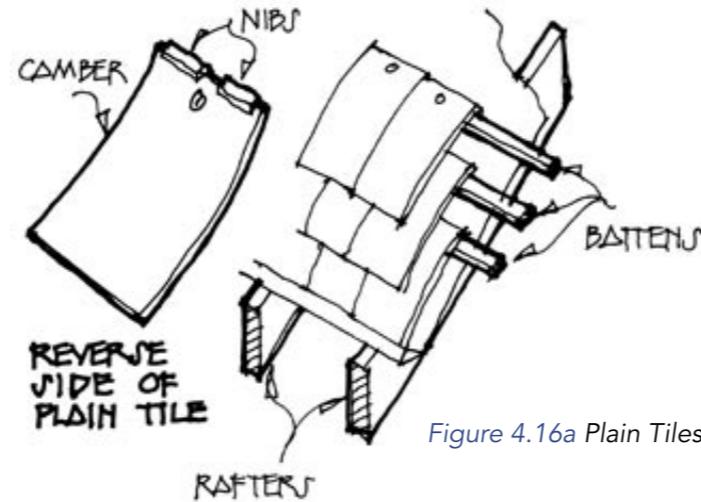
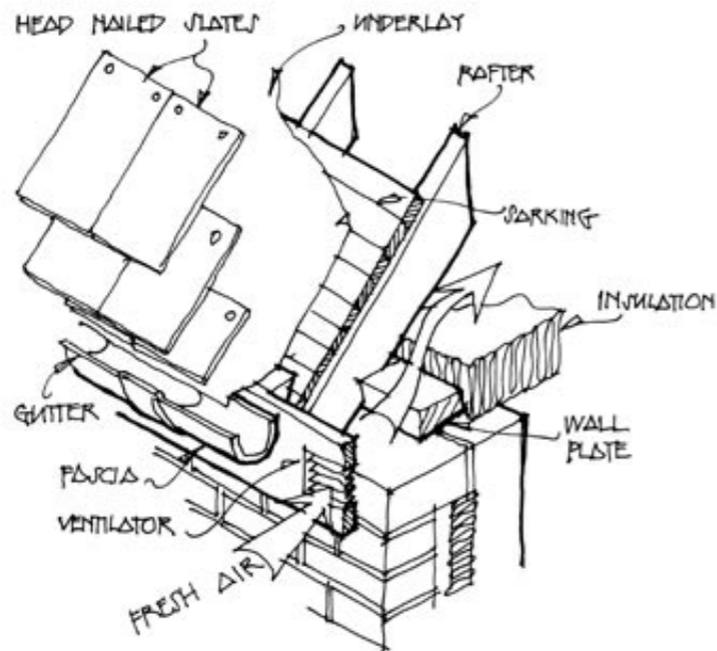


Figure 4.16a Plain Tiles

Slate ridges may be made using materials such as zinc as a cap that covers the top courses of slates. The ridge could also be formed using tiles to cover the top slates in a similar manner to the tiled ridge illustrated in Figure 4.16b. A slated verge follows the principles of a tiled verge using slate-and-a-half slates on alternate courses to maintain the staggered joints between courses. A layer of slates is laid on the gable wall as an 'undercloak' and the slate ends are bedded in mortar along the verge (see Figure 4.16c).

**Tiles**

There is an immense range of tiles available that might be categorized as follows: tiles that overlap between courses and abut at the sides (such as plain tiles); tiles that interlock at the sides and between courses (such as pan tiles); and

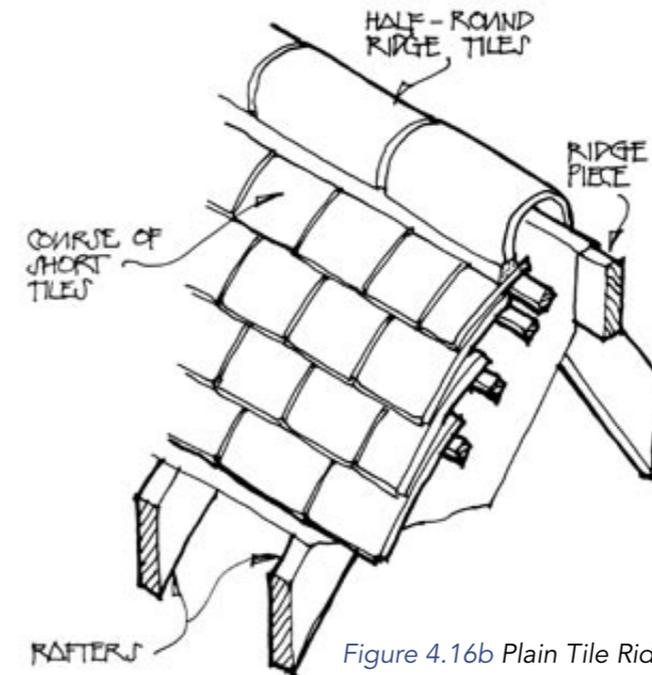


Figure 4.16b Plain Tile Ridge

tiles that interlock at the sides and between courses (such as interlocking slates).

Clay is the traditional material used for the manufacture of roof tiles, while concrete is a very widely used less expensive alternative.

**Plain Tiles** are small - typically 265 x 165mm (9.5 x 6.5") - and are designed with a slight camber so that, when laid, water is unable to creep under them by capillary attraction

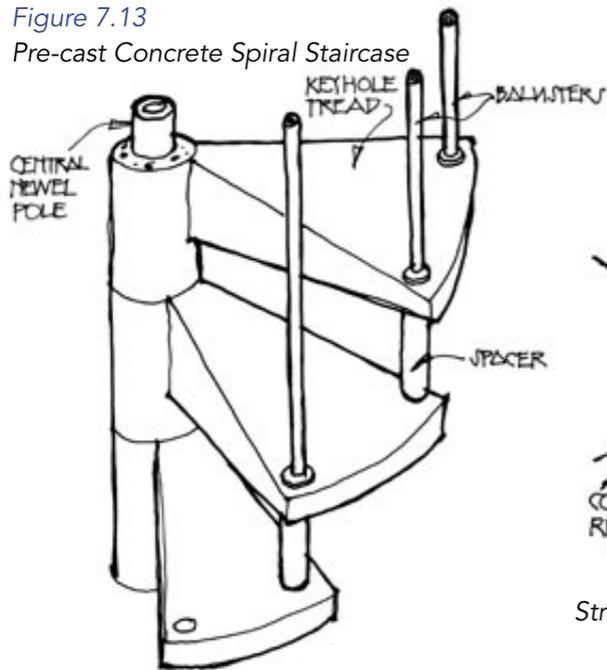


Figure 7.13  
Pre-cast Concrete Spiral Staircase

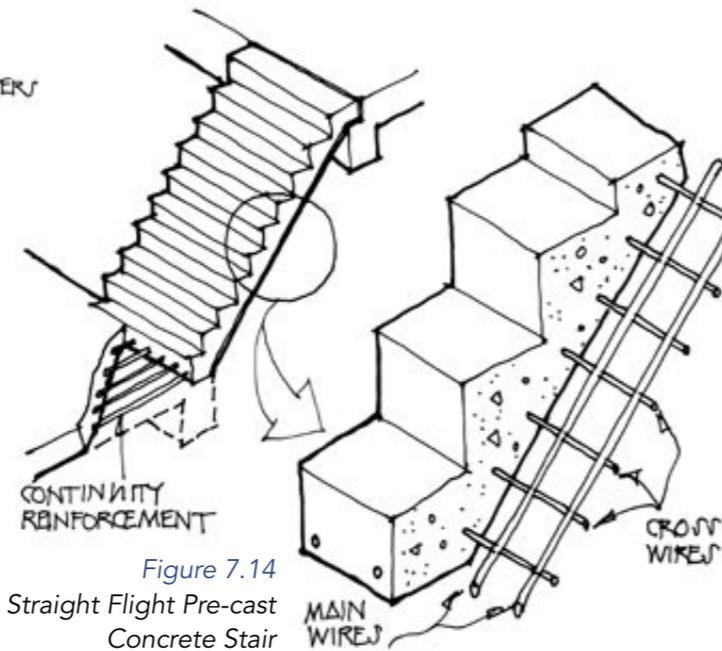


Figure 7.14  
Straight Flight Pre-cast Concrete Stair

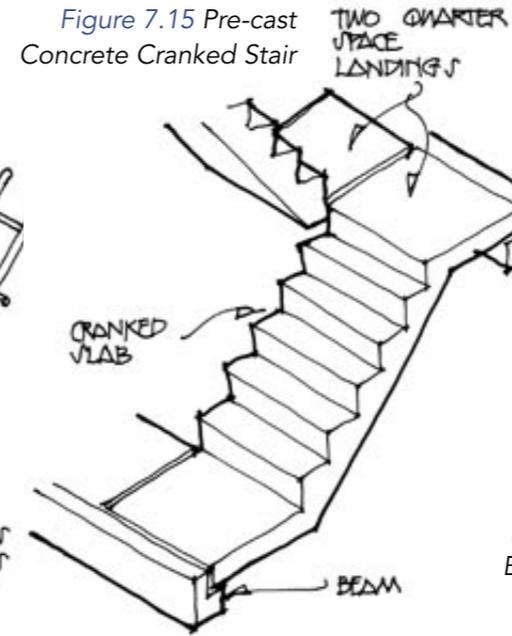


Figure 7.15 Pre-cast Concrete Cranked Stair

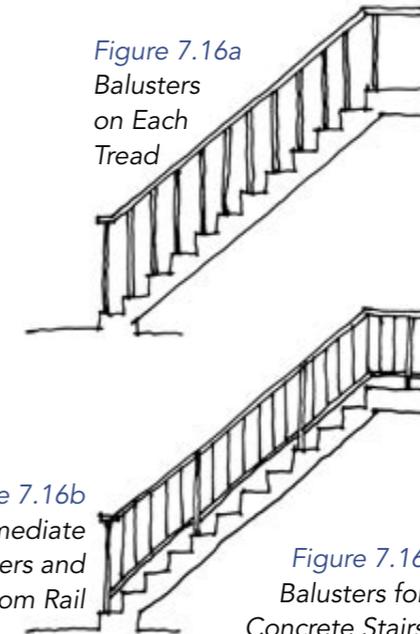


Figure 7.16a  
Balusters on Each Tread

Figure 7.16b  
Intermediate Balusters and Bottom Rail

Figure 7.16  
Balusters for Concrete Stairs

**Pre-cast Cranked Stair** (Figure 7.15) This is a straight flight that incorporates a quarter-space landing at the top and bottom. When two or more cranked stair units are installed, the quarter landings are linked to form a half-space landing. The stair is reinforced in a similar manner to the straight flight stair (above) with continuity reinforcement in the side of the landing area to link with that of the adjacent cranked stair unit.

**Handrails, Balusters and Nosings for Concrete Stairs**

Most concrete stairs are fitted with mild steel balusters and handrails. Figure 7.16 compares two alternative approaches: where the balusters are fitted to each tread and the handrail screwed or welded to the tops of the balusters; and where substantial balusters are fitted to every fourth tread and a 'bottom rail' is installed. Lighter weight mild steel 'standards' span between the handrail and the bottom rail at intermediate intervals between the balusters.

**Handrails** usually comprise a mild steel 'top rail' covered by a plastic or timber section to give comfort. Two alternatives are shown in Figure 7.17: a plastic handrail cover clips over the top rail (a); a timber handrail is screwed from underneath to the top rail (b).

**Balusters** are commonly of hollow, square or round cross section fitted either to the top surface of the tread or to the side of the staircase. Figure 7.18 illustrates a tread