UNESCO-NIGERIA TECHNICAL &
VOCATIONAL EDUCATION
REVITALISATION PROJECT-PHASE II

NATIONAL DIPLOMA IN BUILDING TECHNOLOGY

YEAR II- SE MESTER I
THEORY/PRACTICAL

Version 1: December 2008

BUILDING CONSTRUCTION III

COURSE CODE: BLD 203

TABLE OF CONTENTS

WEEK 12: FLOOR FINISHES CONTINUED

WEEK13: WALL AND CEILING FINISHES

3.3 Wall finishes

WEEK 14: PAINTING

WEEK 15: PAINTING CONTINUED

WEEK 1: SCAFFOLDING

(1.1) Principles of Scaffolding

Scaffolds are temporary working structures made from poles of wood or metal erected around the perimeter of a building or a structure to provide a safe working place at a height that cannot be reached from the ground. They are usually required when the working height or level is 1.500 m or more above the ground level. All scaffolds must comply with the minimum requirements and objectives of the constructions (Health Safety and Welfare) Regulations 1996.

The first use of scaffolding is for the external walls. When the brickwork is about shoulder high, then the bricklayer needs to be raised up to continue working. Below 2 metres the scaffold boards can rest on timber trestles. This is a suitable work surface because the bricklayer can step up and down to get bricks and mortar.

More than 2 metres from the ground, workers need ladders up to the platform, which must be wide enough to hold materials, plant and people. Platforms should be placed at 2 metre intervals as the height of the building increases, so that workers can comfortably reach their working area without hitting their heads as they walk underneath.

Parts of a Scaffold

The basic parts of a scaffold consist of the following and are shown in figure 1.1.

Base boards are timber boards that support the base plate on soft or uneven ground.

Base plates are square metal plates that fit into the bottom of scaffold tubes to spread the load.

Braces are poles fixed diagonally to stiffen the scaffold by forming a triangle.

Standards are the vertical poles that carry the weight of the scaffold to the ground.

Toe boards are the boards along the edges of platforms which prevent materials from falling.

Transoms are cross pieces that rest on the ledgers and support the platform.

Ledgers are longitudinal horizontal components that are fixed to the standards.

Putlogs are transverse horizontal members fixed to the ledger.

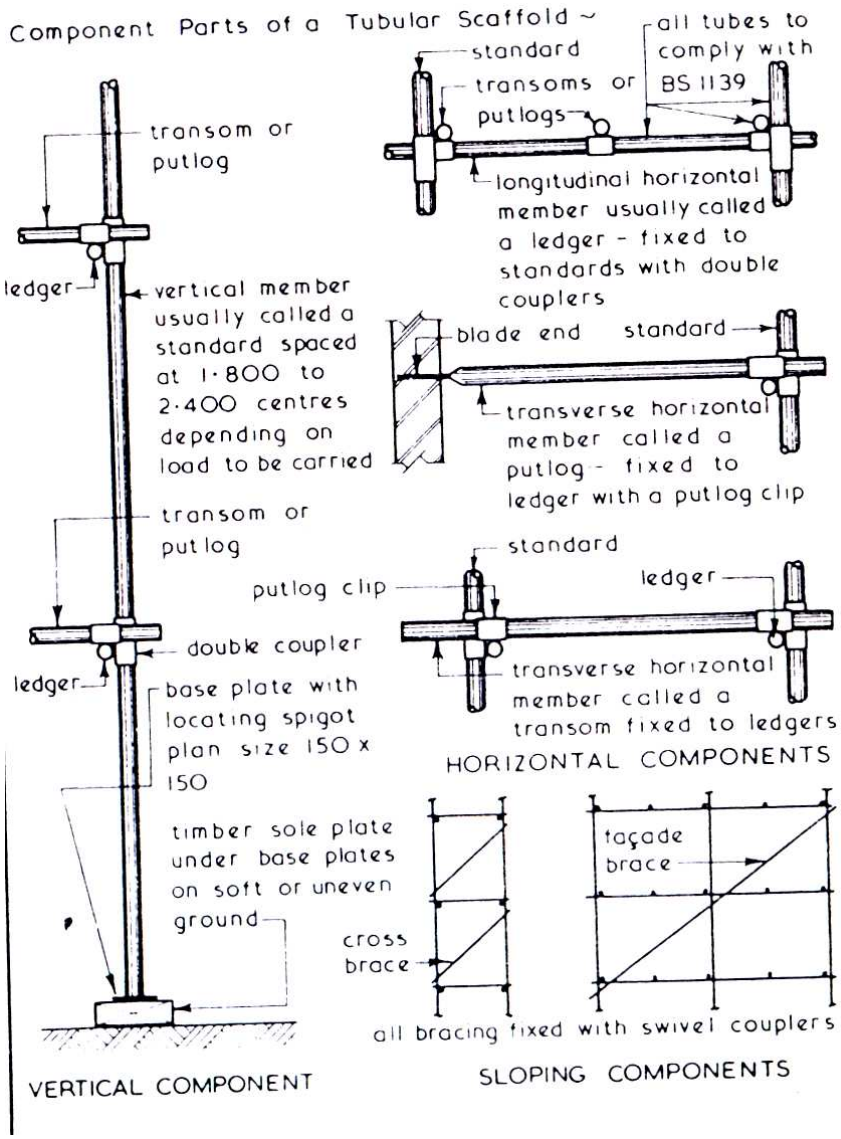


Fig 1.1 Components of a scaffold

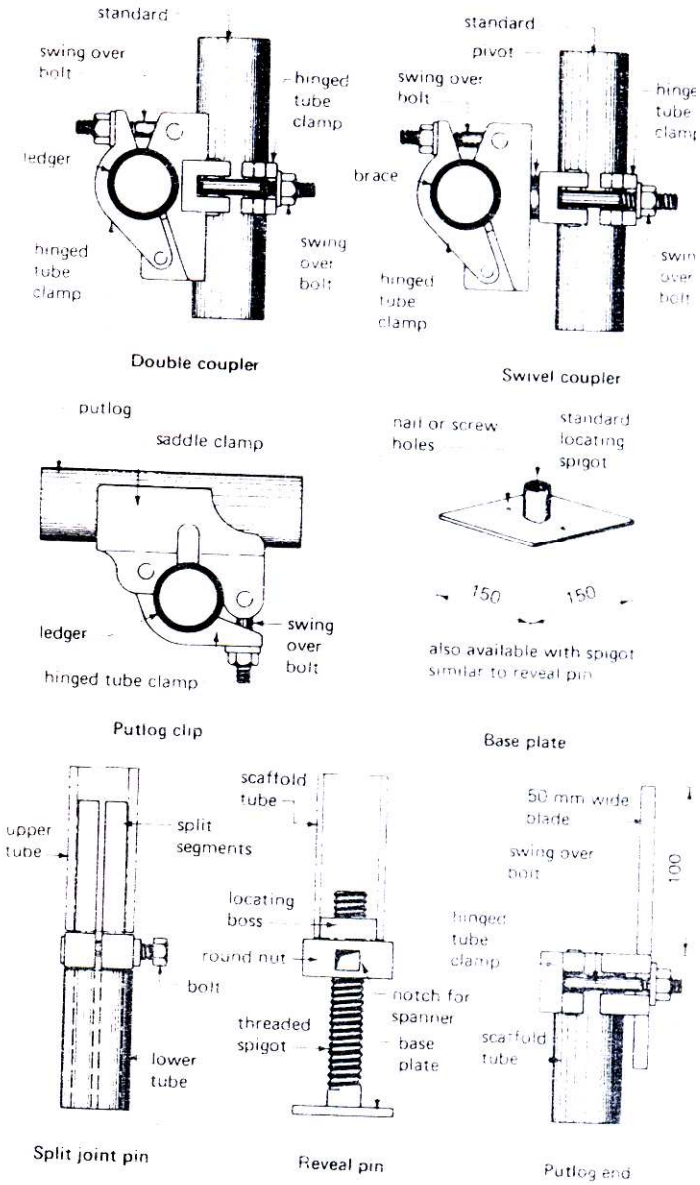


Fig 1.2 Joints and connectors of scaffold parts

Test Questions

1. Define scaffolding
2. List 5 important parts of scaffold and describe them.

WEEK 2: SCAFFOLD CONTINUED

1.2/1.3 Types of Scaffold

- Putlog scaffold
- Independent scaffold
- Mobile scaffold
- Cantilever Scaffold
- Suspended scaffold

Putlog Scaffolds

These are scaffolds which have an outer row of standards joined together by ledger which in turn support the transverse putlogs which are built into the bed joints or perpends as the work proceeds. They are therefore only suitable for new work in bricks
or blocks. A typical putlog scaffold is as shown in fig 1.1

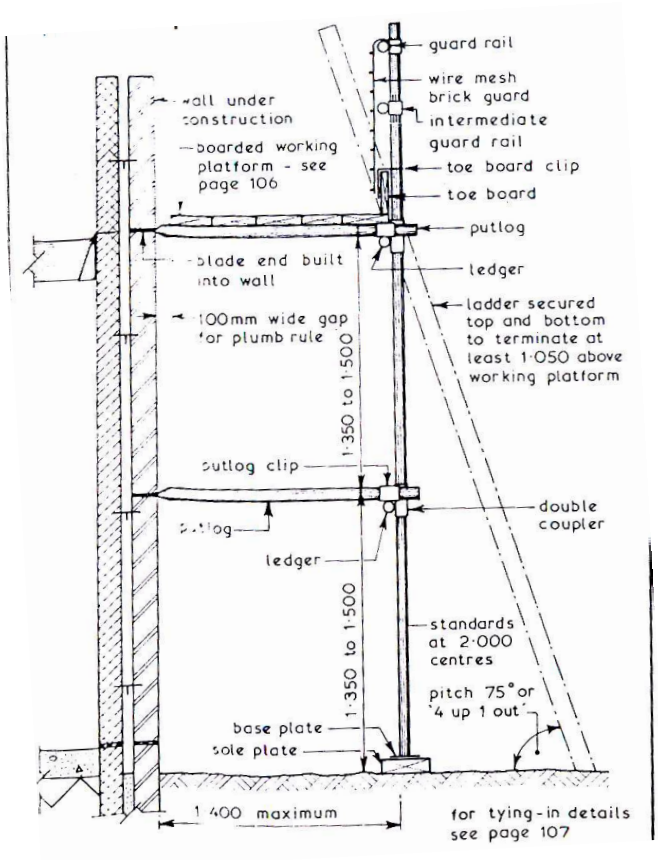
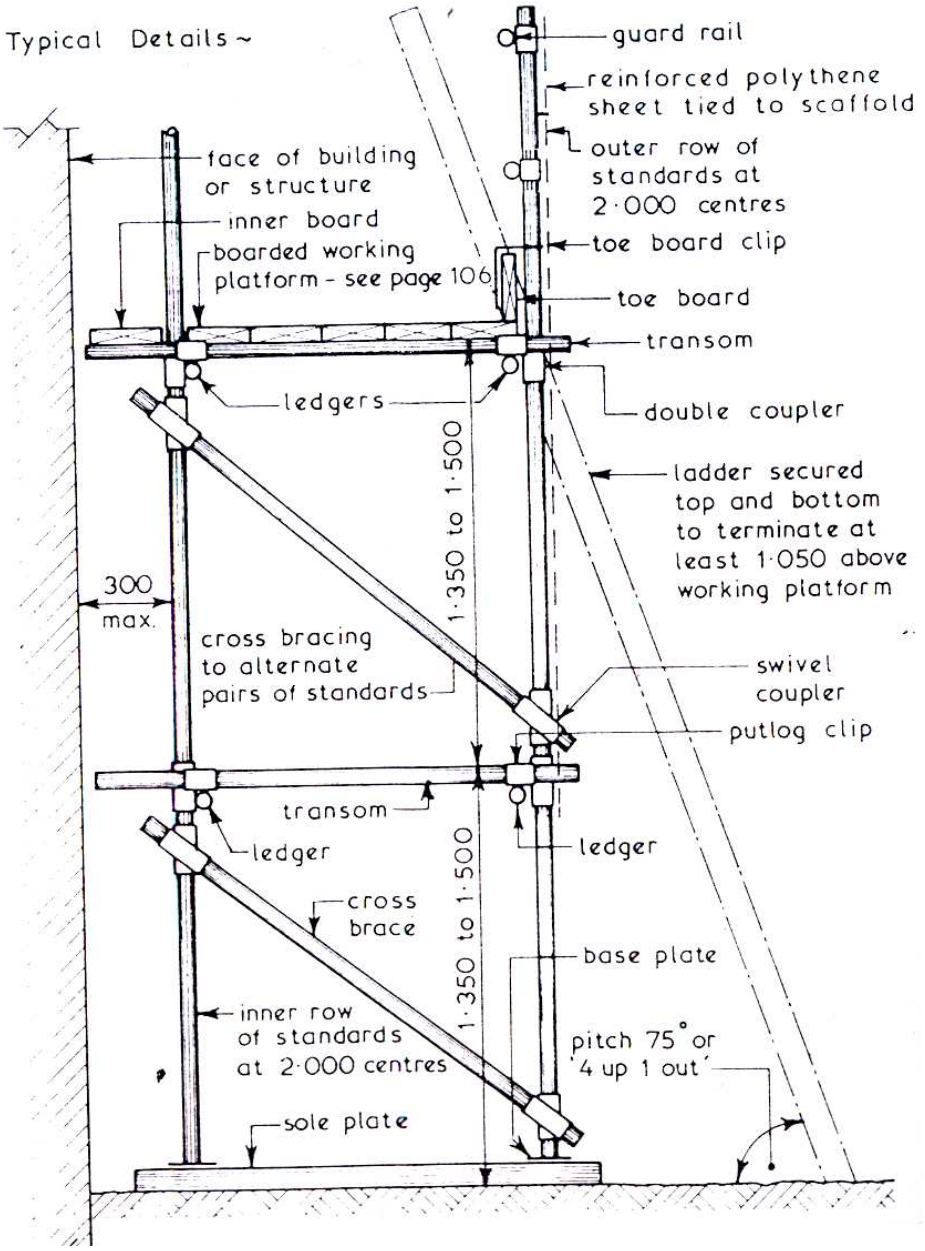


Fig 2.1 Putlog scaffold

Independent scaffolds

These are scaffolds which have two rows of standards each row joined together with ledgers which in turn support the transverse transoms. The scaffold is erected clear of the existing or proposed building but is tied to the building or structure at suitable intervals.



2.2 Independent scaffolds

Mobile scaffolds

Mobile scaffolds sometimes called mobile tower scaffolds are constructed to the basic principles as for independent tubular scaffolds and are used to provide access to restricted or small area and or where mobility is required.

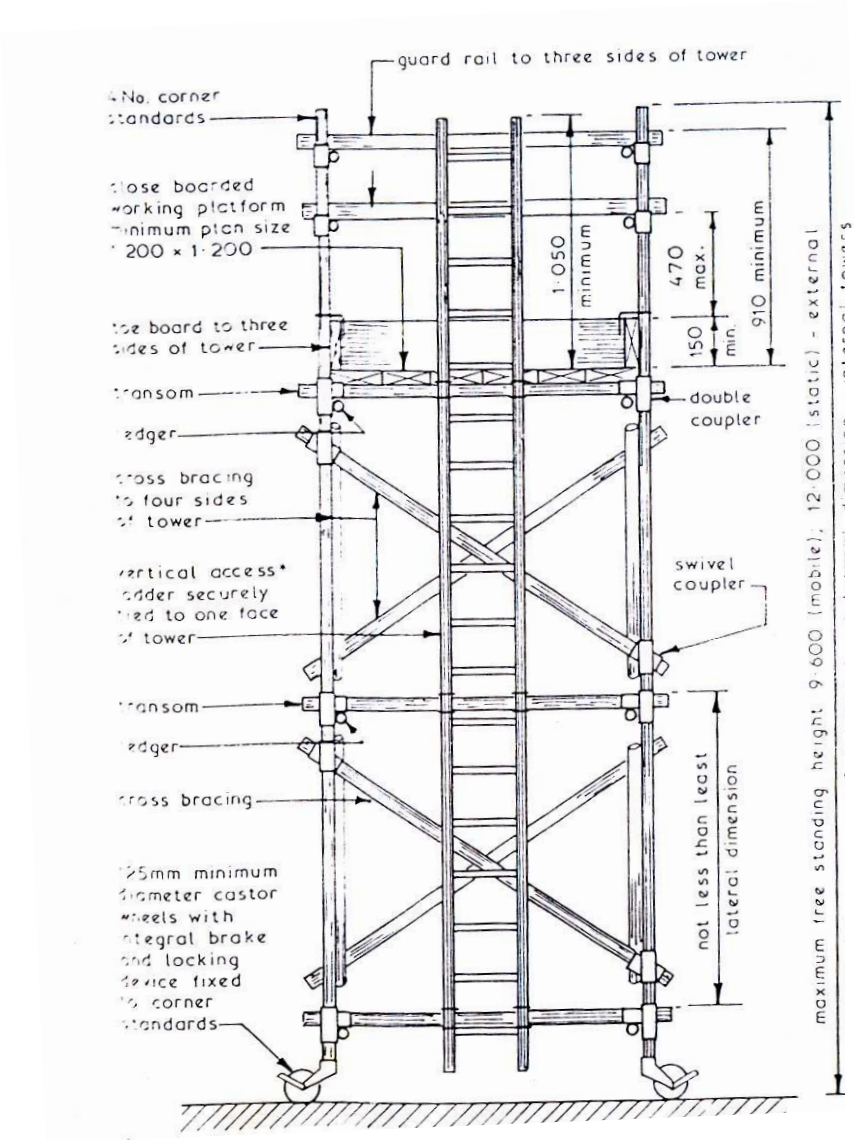


Fig 2.3 Mobile scaffolds

Cantilever scaffolds

These are a form of independent tied scaffold erected on cantilever beams and used where it is impracticable undesirable or uneconomic to use a traditional scaffold requires special skills and should therefore always be carried out by trained and experienced personnel.

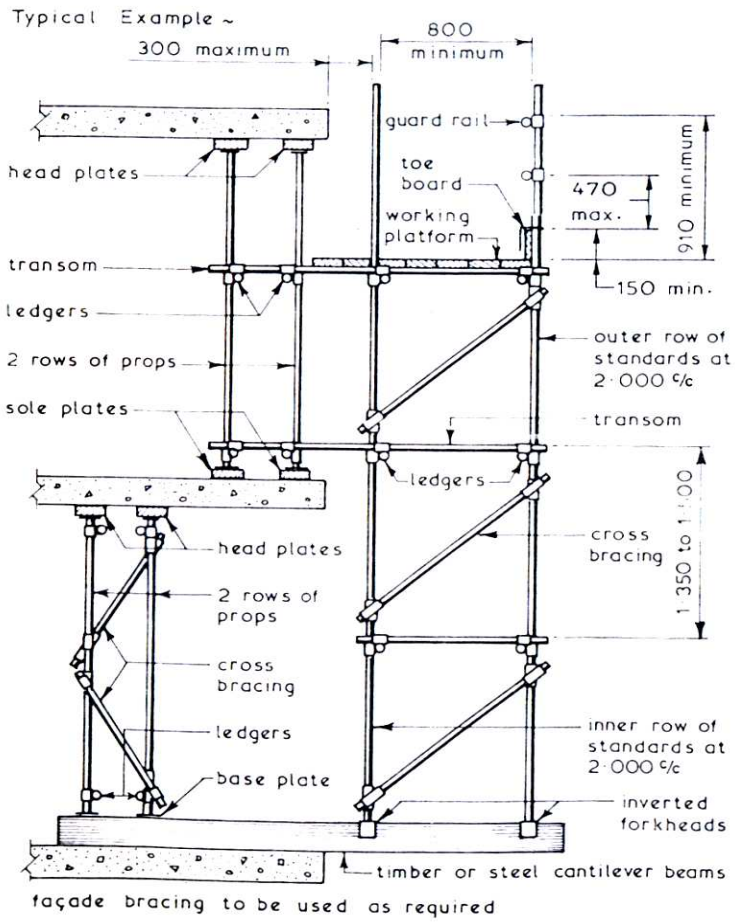


Fig 2.4 Cantilever scaffolds

Suspended scaffold

Suspended scaffold, these consist of a working platform in the form of a cradle which is suspended from cantilever beams or out riggers from the roof of a tall building to give access to the facade for carrying out light maintenance work and cleaning activities.

The cradle can have manual or power control and be in single units or grouped together to form a

continuous working platform. If grouped together they are connected to one another at their allotment ends with hinges to form a gap of not more than 25mm wide.

Many high rise building gave a permanent cradle system installed at roof and this is recommended for all building over 30 m high.

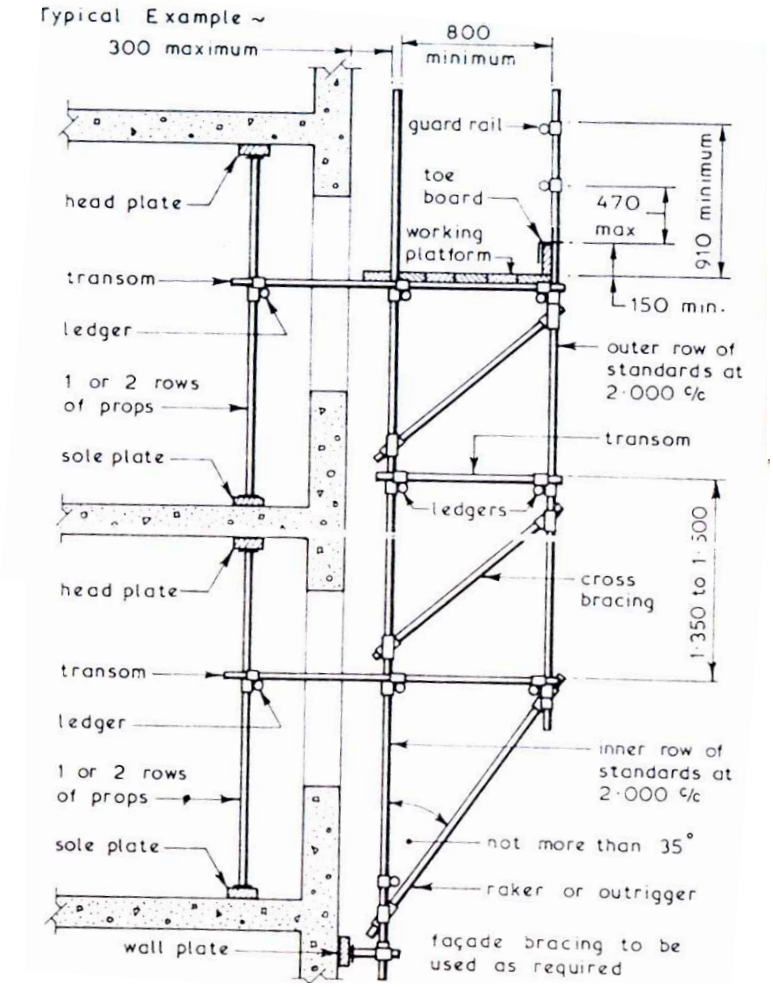


Fig 2 .5 Suspended scaffold

1.4 Use of form work in floor construction

Concrete when first mixed is a fluid and therefore to form any concrete member the wet concrete must be placed in a suitable mould to retain its shape, size and position as it sets. These moulds are called formwork. Formwork provides a level platform to support the wet concrete until it

hardens enough to be self-supporting. The formwork is made from timber boards propped up from the floor below by timber supports. The structure must take account of any beams, lintels and openings. It should be strong and stable so that it can support the weight of people and plant as well as the concrete.

Concrete for floor is basically a four sided box with provisions for beams that may be constructed monolithically with the floor and propped in the correct position and to the desired level. It is essential that all joints in the formwork are constructed to prevent the escape of grout which could result in honeycombing and/or feather edging in the slab cast.

Test Questions

1. Distinguish between Putlog and independent scaffold
2. Use drawing to explain the function of and independent scaffold

WEEK 3: FENESTRATION IN BUILDING

Fenestration refers to openings in a building which allow access for air (ventilation), light, walkways and comfort. These openings are also part of building components. They are namely doors, windows, chimneys, courtyard, screened walls etc

2.1 Functional requirement of opening in walls

Openings are made in walls to accommodate doors and windows, and also on some are made to admit light and air into the building. But these openings forms weakness in walls, and if there happens to be any settlement or shrinkage of materials in the structure, then cracking is most likely to be seen where these openings are. Therefore, it is essential to ensure that care is taken when making opening, in bricks work to achieve the greatest amount of strength and stability of the walling surrounding them.

2.2 Treatment to Openings

An opening consists of a head, jambs and sill. The different methods and treatments which can be used in their formation are many but are based on the same concepts.

All openings should be treated with anti-termite treatments, and anti rust treatment; BSC most materials used for doors and windows are either timber or steel.

Doors and windows are the main openings in brick walls. Their locations are shown on the working drawings together with the head and sill height. These heights should relate to the datum or over site slab level. If this is not the case, then the heights must be recalculated and decision taken as to which courses will take the openings. The brick work is finished neatly on each side of the opening with a stop-end. The method is similar to finishing off at a quoin. Insert a closer before the last header in alternate courses in English and Flemish board.

The sill does not need special treatment but at the head there are alternative methods to carry the brickwork across the opening. These are lintels and Arches.

2.3 Lintels and Arches

Lintel

A lintel (figure 3.1) is a beam that spans across a horizontal opening and supports the load just above the opening. Lintels can be timber or concrete. Timber is fine for short spans but is not durable. For this reason most lintels are built from reinforced concrete.

The lintel can be covered with skin decorative brickwork which needs support. This is done by:

- Bolting a galvanized steel angle to the concrete lintel.
- building the decorative brickwork on the edge of the angle;
- Tying the brick joints to the lintel with metal ties.

Constructing concrete lintels

Structural engineers design lintels for larger buildings but the following basic guidelines could be used to construct a lintel for domestic scale construction. Table 3.1 gives some basic requirements for smaller lintels.

After designing the lintel, it should be cast (or made). Lintels can be in situ or precast. The span will determine the height of the lintel, which should correspond to the height of full brick courses.

Table 3.1 Standard dimensions for lintels

Span (mm)	Depth (mm)	Reinforcement sizes (mm)
900	150	10
1200	150	12
1500	215	12
1800	215	16

The design of the lintel should use these additional requirements:

- one reinforcement bar for each 112mm width of lintel;
- the width must be at least 1/20th of the span;
- the bearing of the lintel must be more than 150mm;

- at least 25mm of concrete must cover the bottom of the reinforcement bar;
- at least 50mm of concrete must cover the ends of the bar.

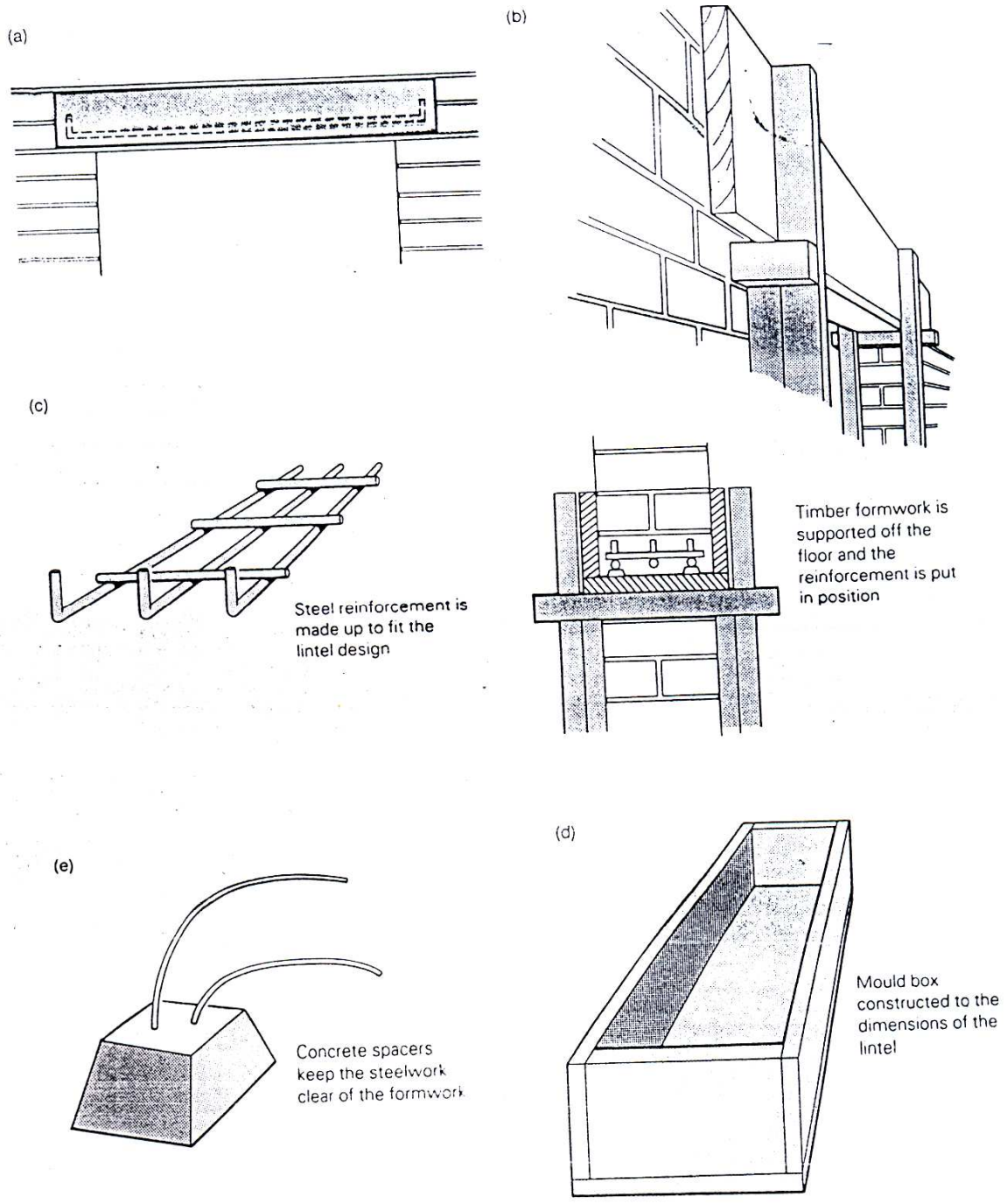


Fig 3.1 Construction of a concrete lintel

Test Questions

1. What is the meaning of Fenestration in buildings
2. State 3 ways in which a decorative brick work can be used to cover a lintel
3. What is the use of a spacer

WEEK 4 ARCHES

2.3 Arches

Arches can be made from bricks or stones to span openings and support the structure above them (figure 3.2). An arch depends upon the tension in the structure for its stability. The downward pressure forces the units of the arch together and increases their resistance as long as the load does not exceed the strength of the arch building materials.

The advantages of segmental and semicircular arches are:

- They avoid the need for concrete and steel
- They use local stones or bricks
- Their appearance is pleasing in many stones or brick buildings

The disadvantages of these arches are

- Doors and windows will need timber frames to fit the curve snugly.
- The timber centers piece or turning pieces must be made accurately.
- Arches must be formed in situ

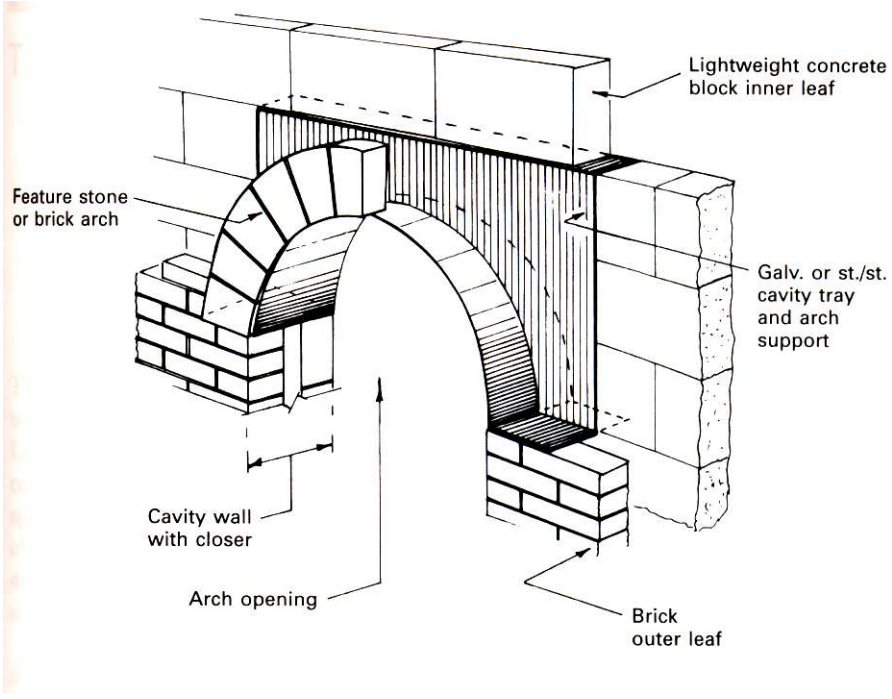


Fig 4.1 Construction of a brick arch

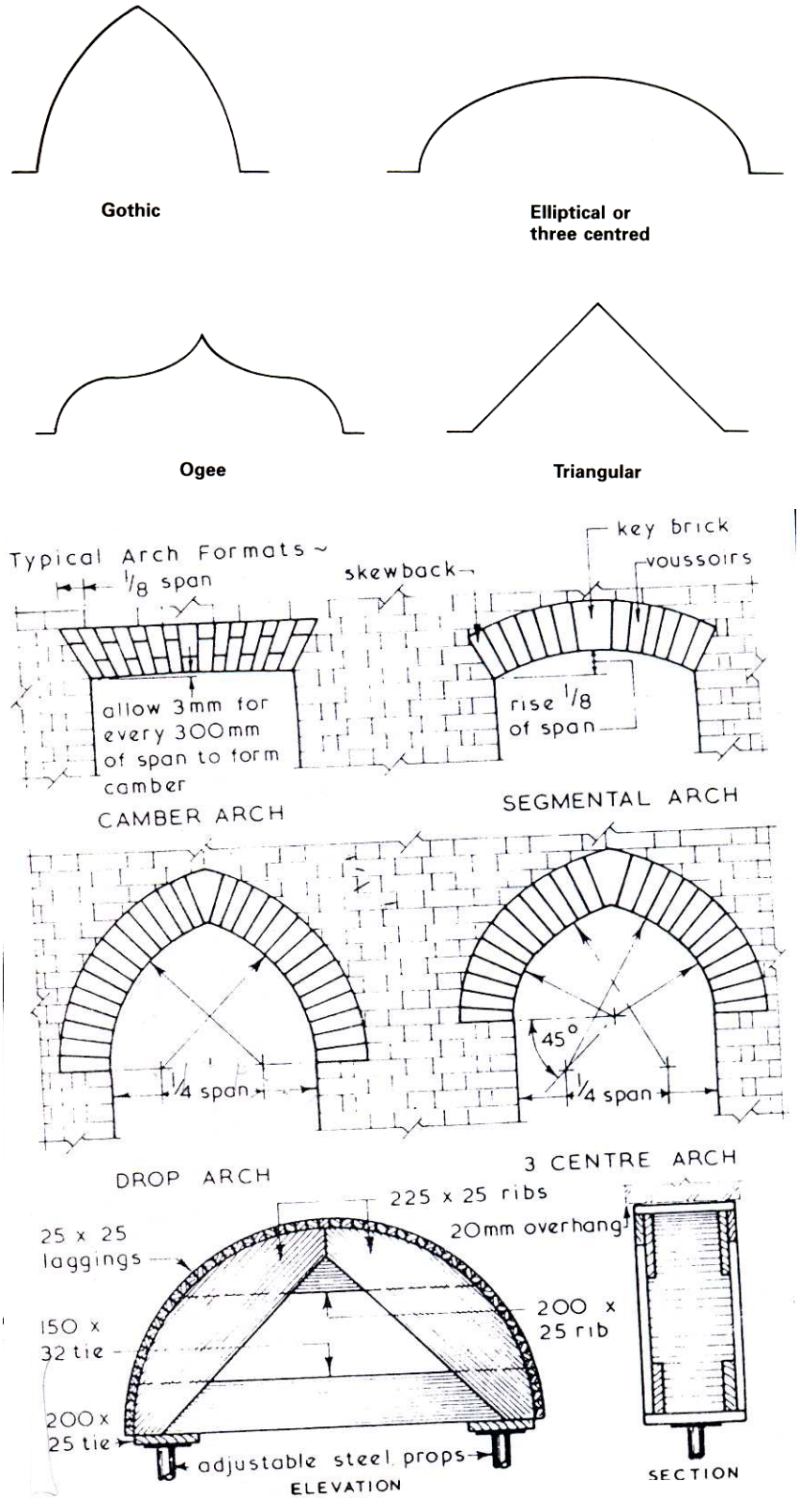


Fig 4.2 Types of arch

Test Questions

1. State the function of Arches in a building
2. Use drawing to show 4 types of Arches

WEEK 5: DOORS

2.4 Types of Doors

There are many ways of classifying doors among which are the method of opening; the materials from which they are made as well as the method of construction.

Classification of doors

Based on the method of construction, doors are classified into the following types

- Paneled doors
- Flush doors
- Match doors
- Framed ledge and braced doors
- Folding doors
- Garage doors

Based on the materials from which they are made they could be classified into:

- Metal doors
- Timber doors
- Glass doors
- Doors from any combinations of the materials above

Performance Standards

A door, depending on the type, should meet certain standards for:

- Weather resistance
- Security
- Fire resistance
- Sound insulation
- Privacy
- Operation
- Durability

Weather resistance

External doors need a minimum gap of 2mm for free movement. This gap should be sealed with suitable draught and water exclusion materials to make the doors weather resistant. This is because the external door forms part of the external envelop of a building and should therefore have a similar level of weather resistance against weather elements like rain, sunlight and driving wind.

Security

The security of a door depends on the materials used, the quality of the frame and the ironmongery. Internal doors only need to provide minimal security. For example, a bathroom door might be fitted with a simple lock. External doors need to be constructed to high specification and fitted with high security locks.

Fire-resistance

Internal doors that separate spaces are usually made of materials that prevent the rapid spread of fire. In the event of fire outbreak they should be able to keep the fire in a compartment for a long enough time for the occupants to have moved from the other spaces before fire will spread through the door. They are also heavy enough to be self closing in the event of a fire outbreak.

Sound insulation

Doors should be able to reduce the level of sound that passes through it so as to reduce the level of discomfort that may be due to excessive sound. Heavier doors provide better sound insulation.

Privacy

Solid doors are the most private. If some light is needed while retaining privacy, then obscure glass should be fitted into the door.

Operation

Doors can swing or slide to open and close. Most doors swing on hinges fixed to door frames. Spring-loaded latches usually hold doors closed. Doors are normally opened with knobs or levers.

Durability

Doors are in constant use. Their construction should be strong enough to withstand considerable activity. A door should not fall off the edge fixed to a frame under its own weight. External doors should be able to resist climatic extremes which can cause the shape to warp

Test questions

1. List 5 classified doors based on method of construction.
2. List 5 standard requirements a door should conform to.

WEEK 6 DOORS (CONTINUED)

2.5 Construction of Doors

The construction method for any particular type of door depends on the material from which the door is made. The following are basic examples of methods of construction of some basic door types.

Flush Doors

Flush doors have no projections or recesses on either surface of the door. These doors are usually made of large sheets of plywood or hardboard. Flush doors may have glazed panels to allow in some light. Flush doors are usually made in factories. This ensures a high quality; durable product if the correct type of door is put in the right location. The plywood facing and the frames for external flush doors should be fixed with waterproof glue.

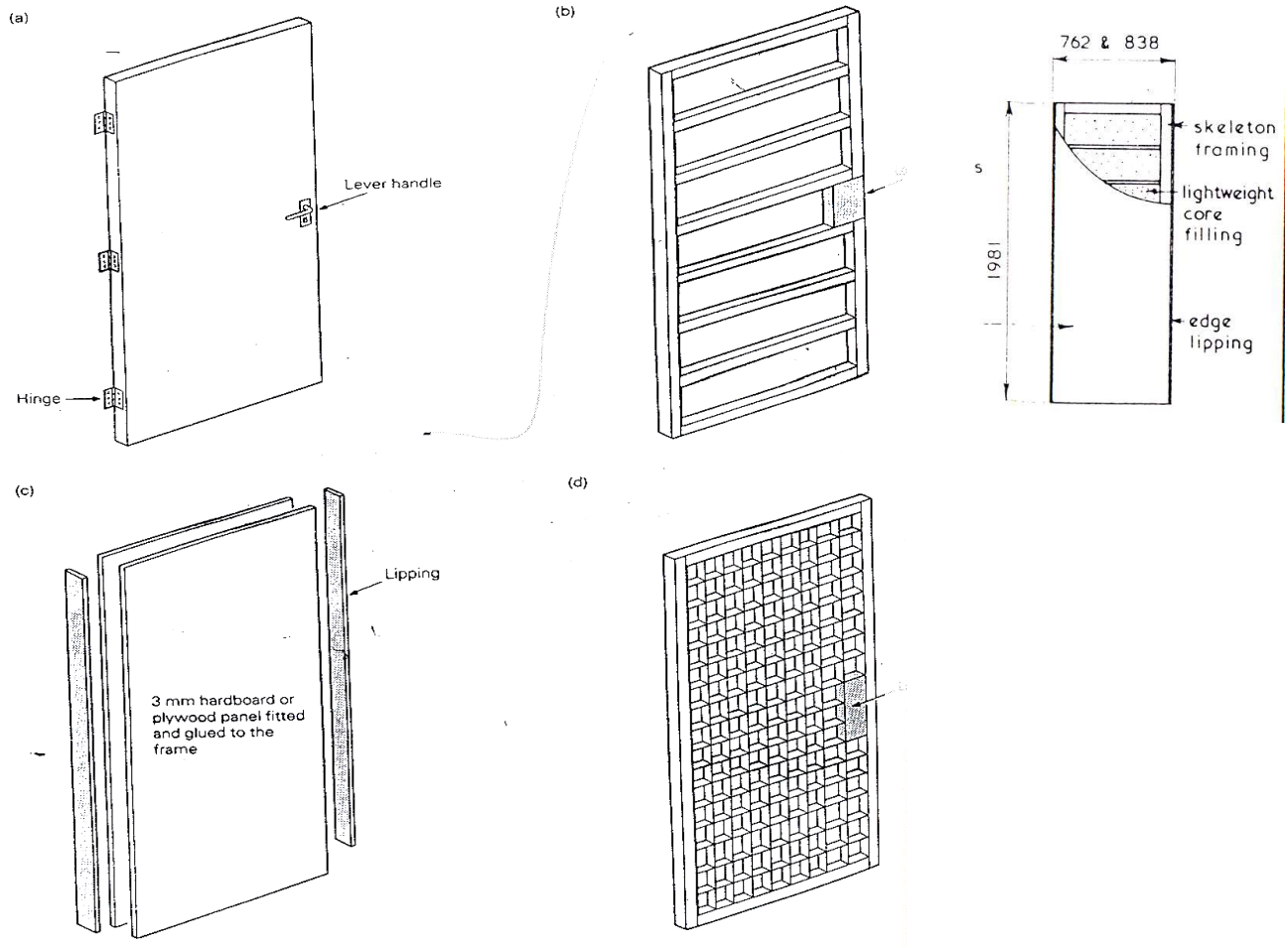


Fig 6.1 Construction of flush doors

Panel Doors

Panelled doors are suitable for internal and external use. They are made from solid timber frames with solid or glazed panels. A panel door consists of the following sections; *intermediate rails* which are cross pieces that divide the door into panels horizontally; the *muntins* are the central vertical pieces; the *bottom rail* is the bottom horizontal framing piece; *panels* are the filling between the framing pieces which can be thin, solid timber, 6mm plywood; or clear or obscure glass.

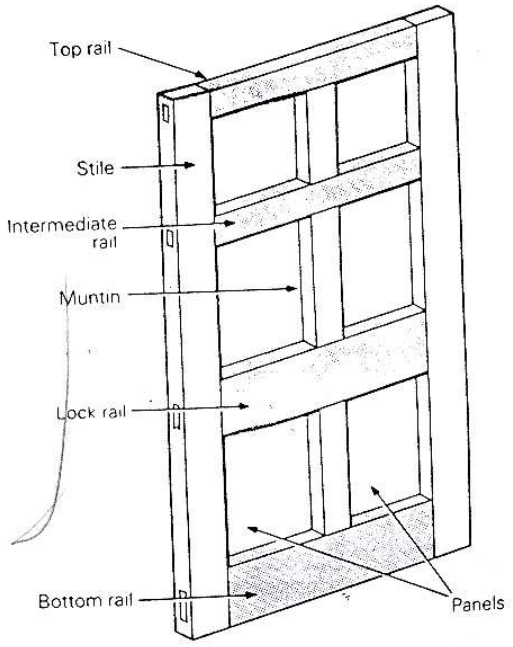


Fig 6.2 Parts of a panelled door

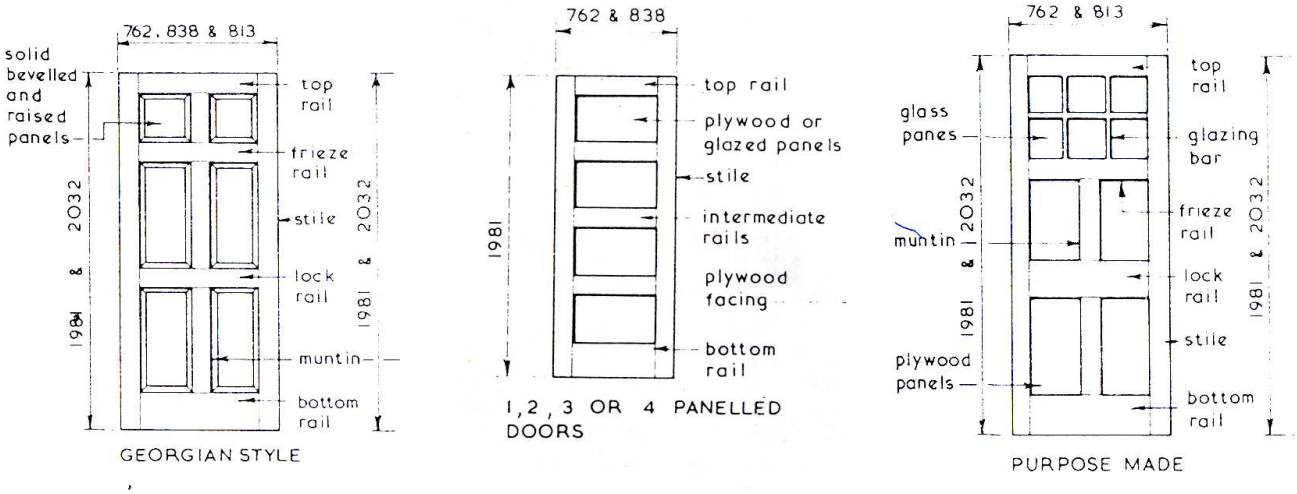


Fig 6.3 Types of panelled doors

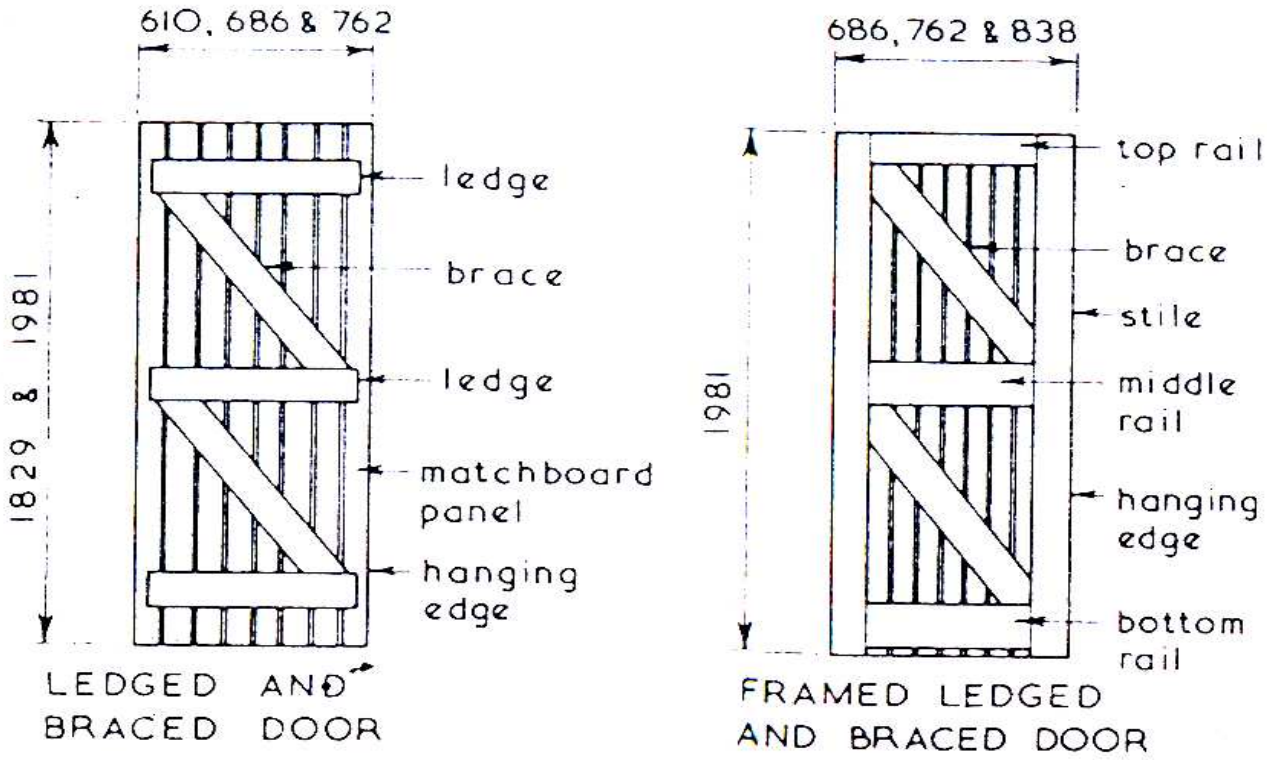


Fig 6.4 Matched boarded door

Test Questions

1. Use drawing to distinguish between a floor door and a panel door
2. Draw a typical wooden door frame and label the parts

WEEK 7 DOOR FRAMES AND LINING

DOOR FRAMES AND LINING

The purpose of door frames and linings is to:

- Define openings
- Reduce the gap between a door and wall
- Provide fixings for the hinges and a recess for the lock or latch
- Provide a finish between the door and the wall.

2.7 Door Frames

Door frames are usually made from solid timber with rebate to house the door. The frame is not related to the thickness of the wall surrounding it. A typical frame for a 50 mm external door could be 125 X 75 mm with a 12mm rebate.

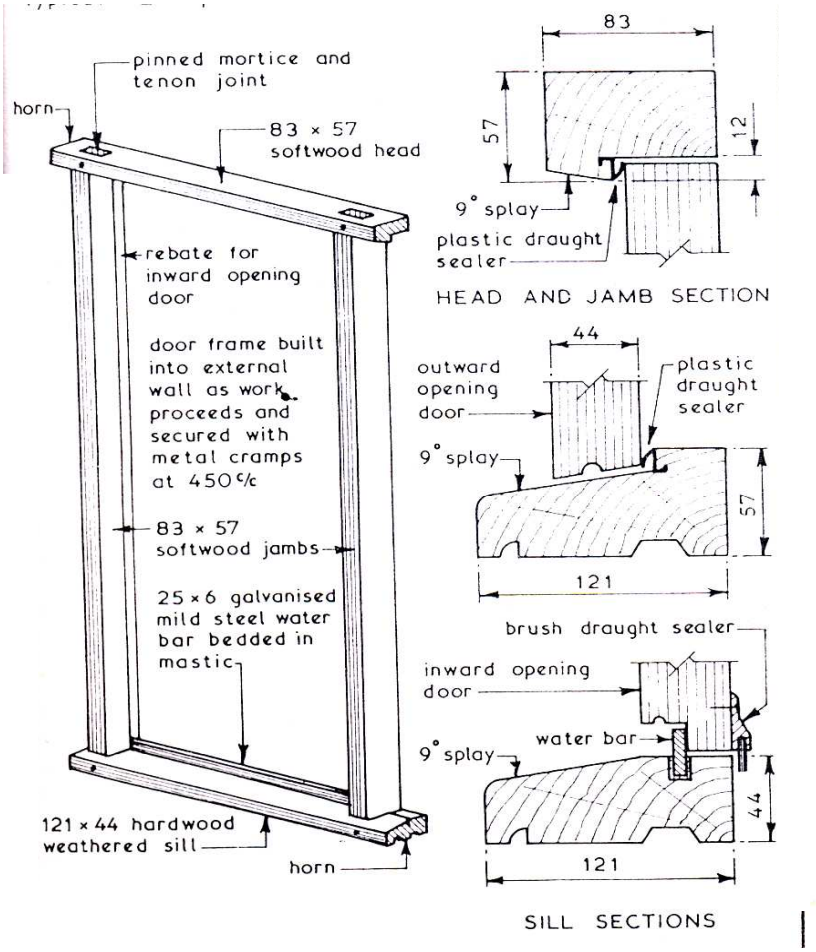


Fig 7.1 A typical door frame

2.8 Door Linings

Door linings are usually fitted to internal doors where the lining is the full width of the wall. A timber stop nailed to the lining provides a rebate for the door to close against.

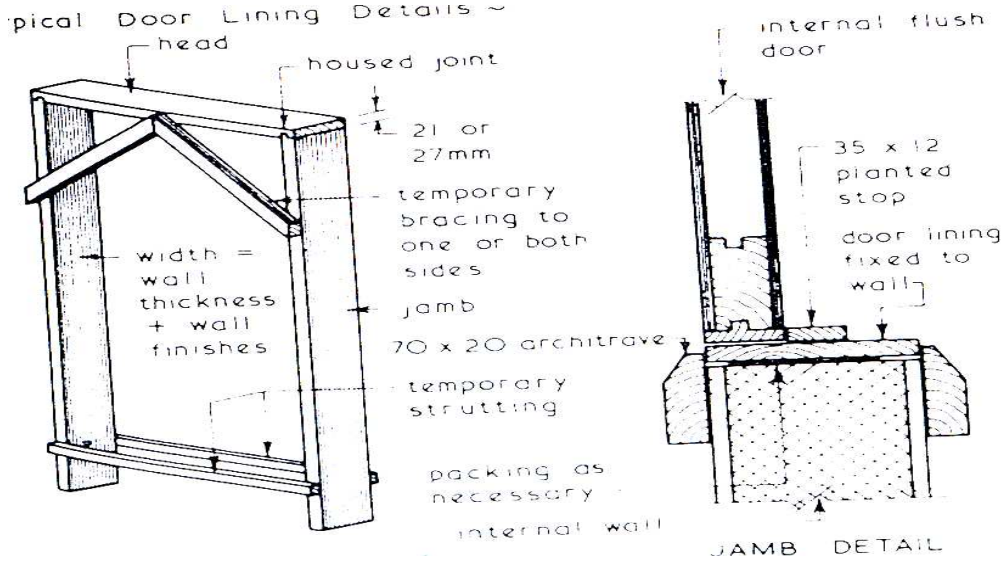


Fig 7.2 Parts of a door lining

2.9 Method of Fixing Door Frames and Lining

The following steps are followed in the fixing of a frame or lining into a place as the wall is built:

- Brace the frame or lining to keep square
- Paint the back of the frame to prevent the entry of moisture from the masonry
- Screw galvanized metal fastenings to the back the frame or lining which match the masonry courses
- Stand the structure in position, level and support it with struts.
- Build the fastenings into masonry joints to secure the frame or lining in position permanently

The following steps are followed in fixing frame or lining into the wall after the wall is built

- Leave an opening that is about 3-4 mm bigger than the frame when the wall is built insert wood plugs into some of the masonry joints that faces the openings during construction
- Put the frame in position after the wall and lintel are built.
- level the frame with small timber pieces
- Drill holes in the frame or lining for screw to go into plugs in the masonry.
- countersink the screws and fill the holes

Test Questions

1. Draw a typical wooden door frame and label the parts.
2. Use drawing to distinguish between door lining and a door frame

WEEK 8 METAL DOORS

2.10 Types of Metal doors

Metal doors as the name implies are made from metals either alone or in combination with other materials.

Steel doors

An example of metal doors is the purpose made steel door constructed using mild steel as the major materials for the construction. There are times where it might become necessary to allow some amount of light to pass through the door into the room. Under such situation the doors are usually constructed and fitted with glass panels in which case they are called steel panel doors. Where there is no panel the door is also constructed like the flush door whereby steel skeleton form the inner core. Steel doors are usually painted both for decoration and protection against corrosion.

Aluminium doors

Another common type of metal doors are the aluminium doors that are usually constructed using aluminium frames with either glass panels or panels made using aluminium sheets. Aluminium doors are usually lighter than steel doors and have higher resistance to corrosion and therefore do not need any paint coating.

2.12 Ironmongery

The term ironmongery refers to devices or little accessories that are parts of doors and windows used for locking, securing, fixing and constructing them. The ironmongery includes locks, latches, bolts, furniture check gear.

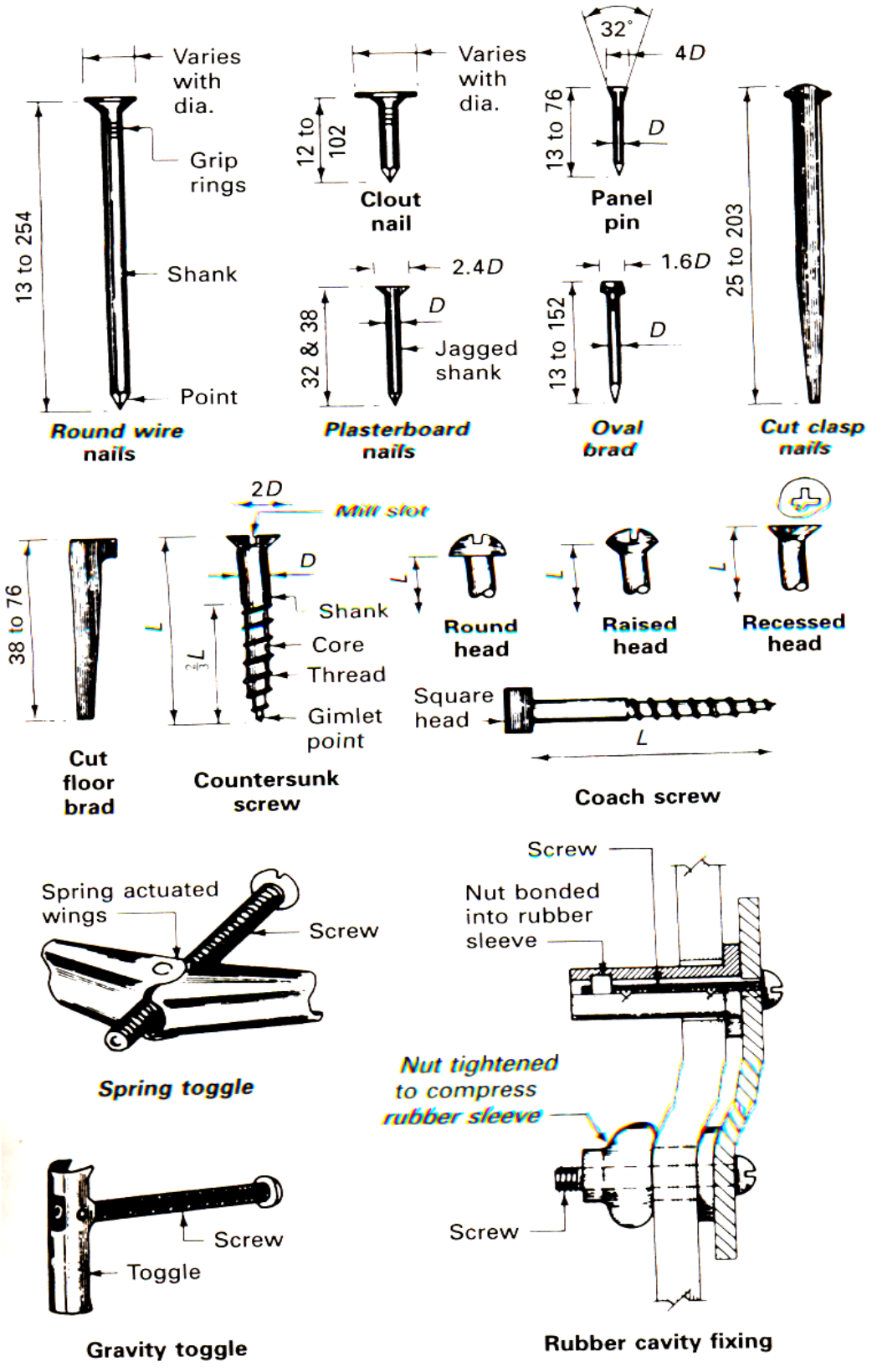


Fig 8.1 Examples of ironmongery

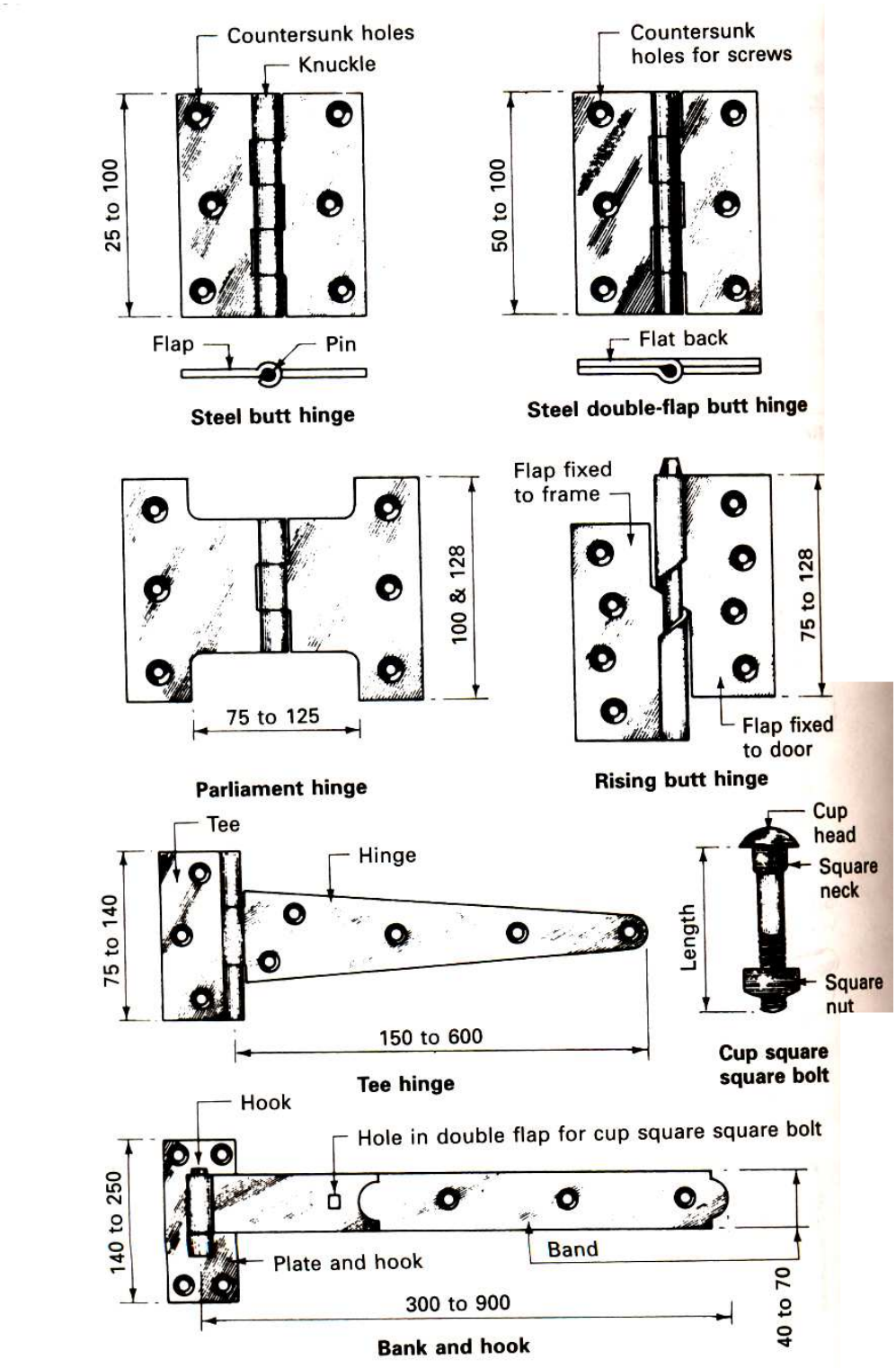


Fig 8.2 Examples of ironmongery continued

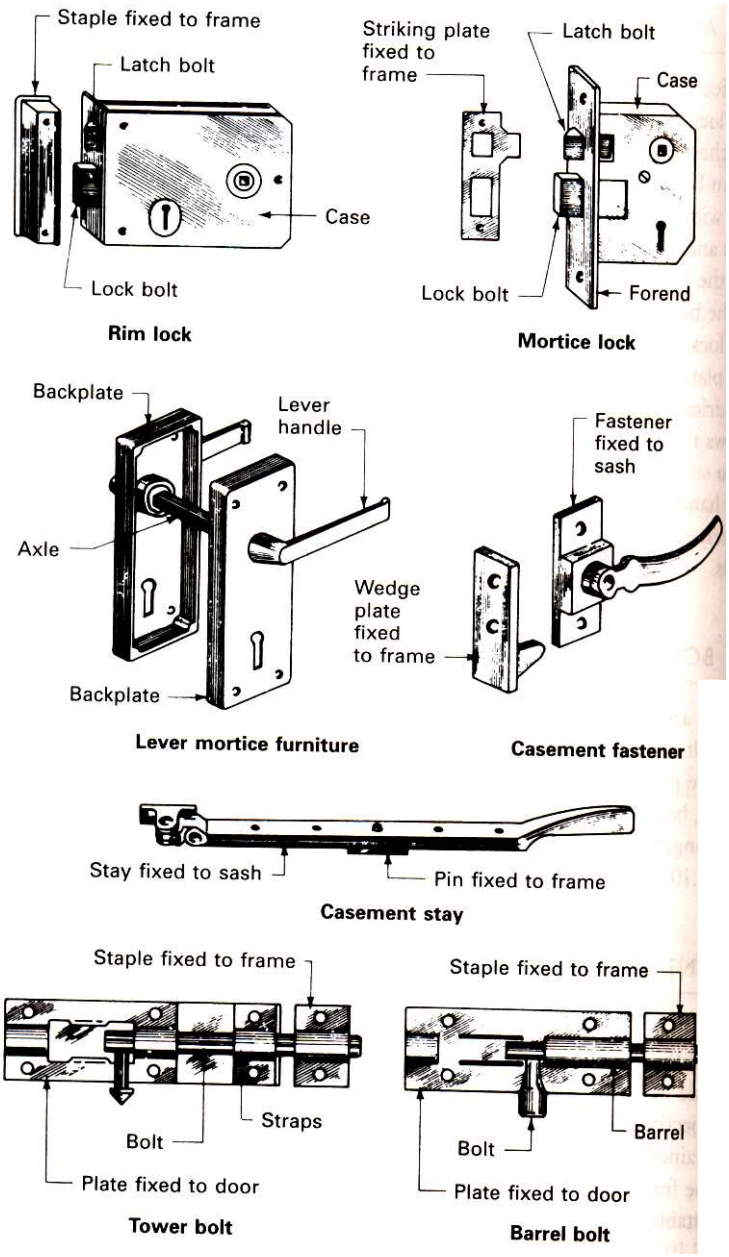


Fig 8.3 Further examples of ironmongery

Test Questions

1. State the advantage of using Aluminium doors over steel related doors.
2. List and draw 5 types of Ironmongery for door

WEEK 9 WINDOWS

Windows

Windows provide natural lighting and ventilation to the interior part of the building while excluding rain and insects. The glass in windows must be strong enough to resist wind pressure. This means the thickness of the glass increases as the size of the glass pane increases.

Windows are usually made of timber or steel, but other materials such as plastic and aluminium are also popular. Windows also provide point of entry into a building; it may as a result need locks or burglary bars for security.

A window must be aesthetically acceptable in the context of building design and surrounding environment. For example, glass and glazing should be suitable for window position and type; suitable and durable materials required for its framing; suitable and durable materials for the window itself; thermal and sound insulation properties to be acceptable to client and to be within building regulations; sizing of openings to meet requirements of building regulation for limiting heat losses. Windows should also be weather tight.

Windows should be selected or designed to resist wind loadings, be easy to clean and provide safety and security. They should be sited to provide vision and therefore visual contact with the world outside the building is important.

2.13 Types of Window

Based on their methods of opening, standard windows can have four different types which are as follows:

- **Side- hung** windows have hinges on one side and the fastening catch and handle on the other.
- **Top- hung** windows have hinges at the top and a securing stay at the bottom. This window opens out.
- **Bottom- hung** windows have hinges at the bottom and a securing catch at the top. This window opens in and needs a special stay to stop it falling into the room.
- **Louvres** are individual pieces of glass held in clips and opened by a lever arm which locks

the louvres in position.

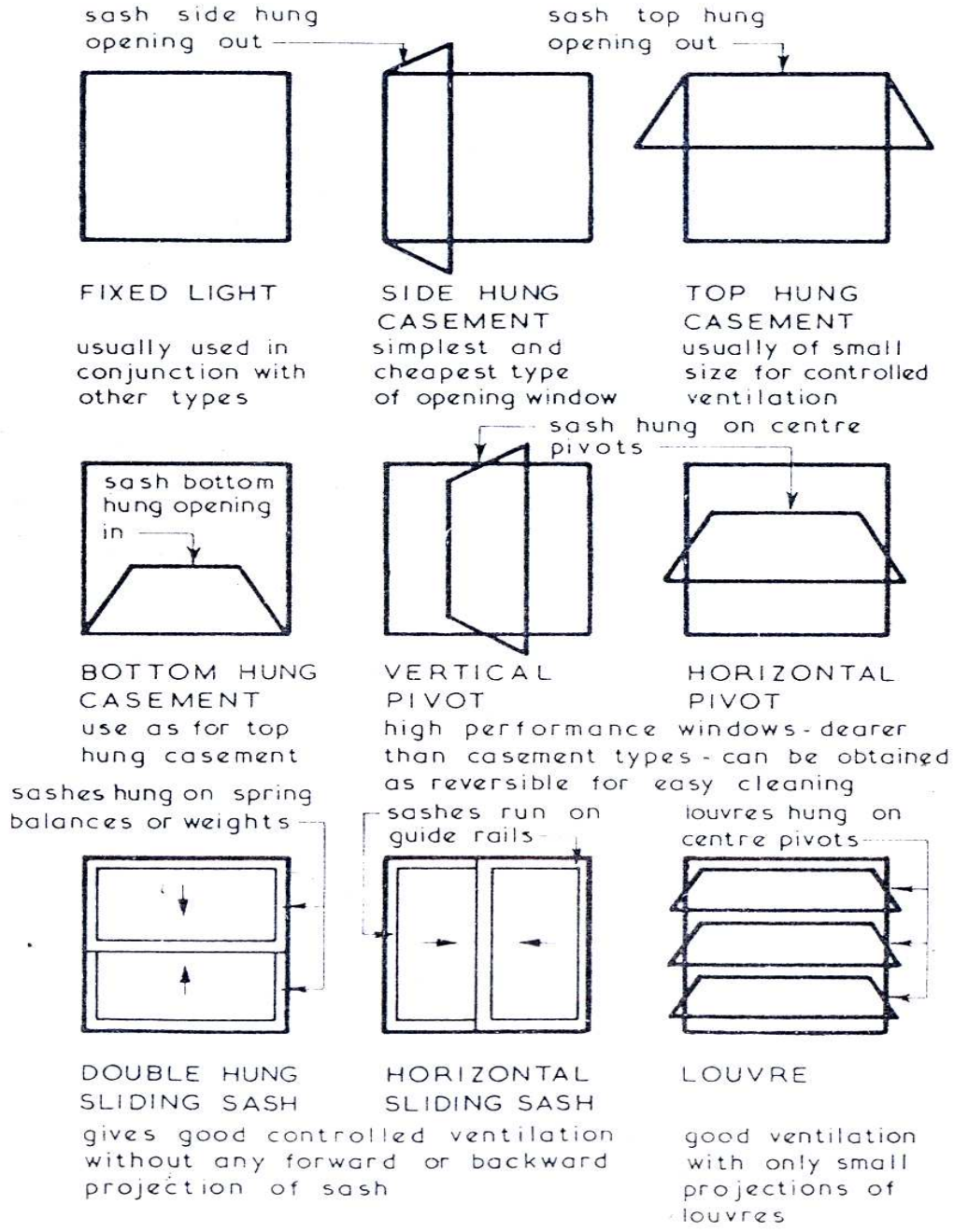


Fig 9.1 Types of windows

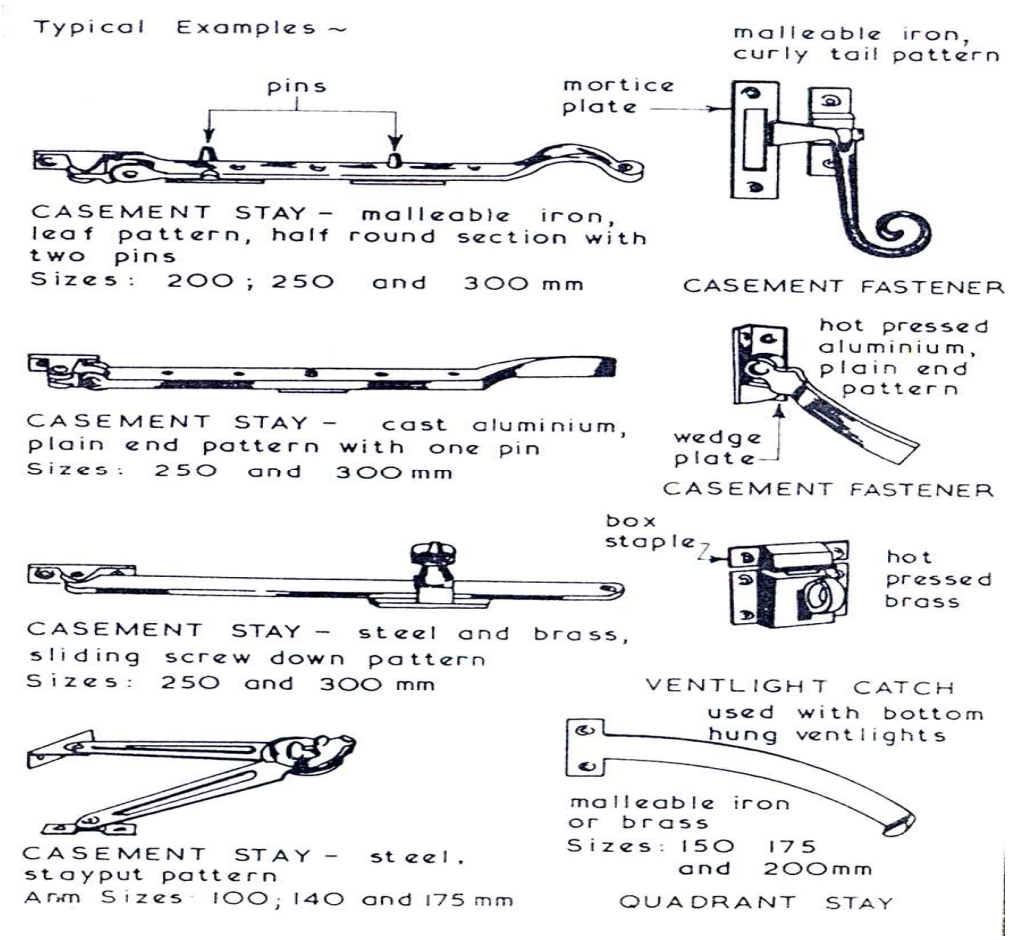


Fig 9.2 Ironmongery for windows

Test Questions

1. Draw 5 types of window operating pattern
2. State 4 function requirement of windows

WEEK 10 PARTS OF WINDOWS AND DOORS

2.15 Parts of windows and doors

Parts of a Window

The following are the main parts of windows and frames.

- **Bottom rail** is the bottom member of a sash or light.
- **Head** is the top piece of a window, which is fixed to the underside of the masonry.
- **Casement** is a side-hung opening window.
- **Cill** is the bottom piece of a window, which is fixed to the bottom of the opening.
- **Jamb** is the vertical side piece fixed to the surface of the window opening.
- **Mullion** is a fixed vertical piece in the window framework, which separates the fixed and the moving parts.
- **Opening light** is another name for a sash.
- **Sash** is the whole moving part of a window including the glass.
- **Stile** is the side member of the sash.
- **Top rail** is the top member of a sash.
- **Transom** is the fixed horizontal piece that separates the fixed and moving parts of the window.
- **Ventilator** is a small sash, which is often top-hung to provide secure ventilation.

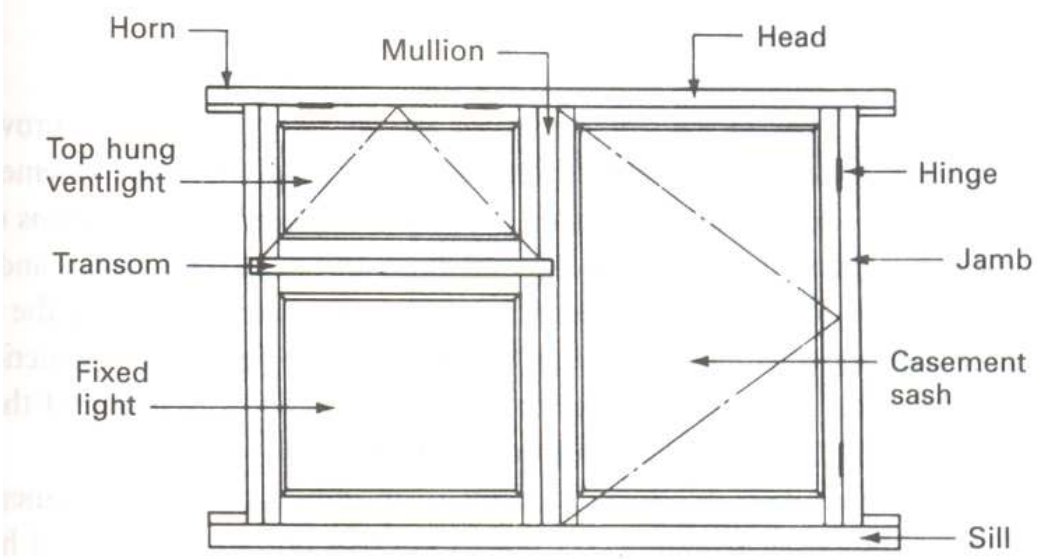


Fig 10.1 Parts of a window

10.2 Parts of a Door

A typical door consists of the following parts.

- **Cill** is a horizontal member at the base of an external door that separates the internal and external structure. It should slope so that rainwater flows outside rather than inside.
- **Frame** is a solid timber or metal structure fixed to a wall. It is constructed so that it forms a seal when the door closes and supports the door's weight.
- **Head** is the horizontal piece at the top of the frame.
- **Jamb** is the vertical part of the frame that is fixed to the wall.
- **Lining** the timber framework inserted into an opening in an internal wall.
- **Rebate** is a recess in the door frame that seals the edges of a door.
- **Stile** is the outer vertical piece of a door frame.
- **Stop** is a thin piece of timber fixed to the head and jambs of the lining to form a rebate.
- **Threshold** is the access point in the doorway where one enters or exits the door. The cill is also part of the threshold.
- **Water bar** is a metal bar fitted into the cill of an external door to prevent water flowing inside.
- **Weatherboard** is a horizontal piece fixed to the external bottom edge of a door to push water away from the cill.

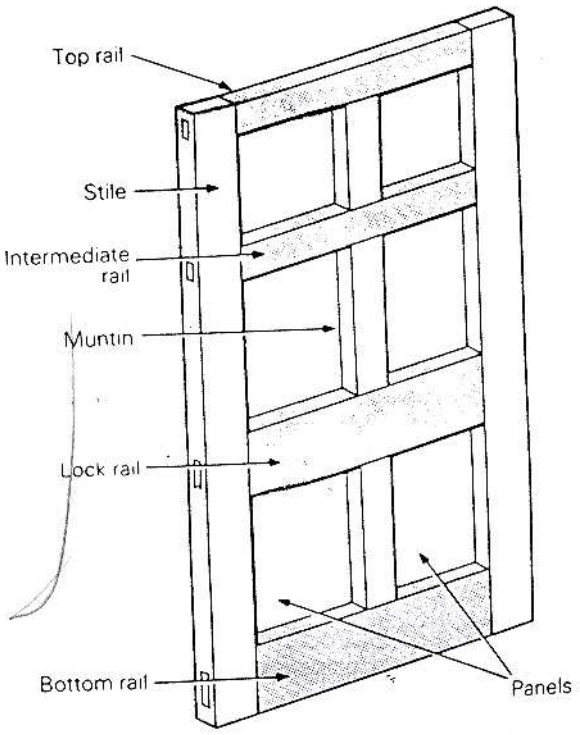


Fig 10.2 Parts of a typical door

Test Questions

1. Draw a typical casement window and label the parts.

WEEK 11 FINISHES

3.1 Functions of Finishes

Finishes are the treatments that are put on internal floors, internal and external walls ceilings and soffits of suspended floors. They serve decorative and practical functions. They improve the appearance of the structures underneath, and also prolong building life spans.

The treatments called finishes include:

- plastering
- rendering
- painting

Plastering

Plastering is the application of a smooth coat of material to walls and ceilings. The purpose of plastering is to provide a jointless, hygienic, easily decorated smooth finish to walls. Plaster covers up the unevenness of bricks, blocks or concrete.

Plaster is mixed with water to make a plastic mixture, which can be spread directly on a surface in thin layers of about 10 mm thickness. The surface absorbs the water in the mix by a process called suction. The suction process stiffens the plaster rapidly so that it can be leveled while it sets and hardens. When the plaster dries it leaves a hard, smooth finish for decoration.

Plaster consists of powdered cement, sand and lime or gypsum. All these materials except sand are supplied in bags.

Rendering

Rendering refers to the process of applying a cement and sand plaster coat to the outside walls of a building. Rendering is applied to

- improve the appearance of concrete block walls
- provide a waterproof finish to porous blocks such as landcrete and sandcrete blocks
- provide a base for colour finish.

Rendering is a mixture of cement and sand. Lime is sometimes added to improve its pliability.

Several kinds of finishes and textures are common to external rendering. They improve the appearance of the cement and sand mix and help to control shrinking and cracking, which affects the waterproof quality of render.

Painting

Painting is the application of a pigmented liquid that stretches thinly across a surface when the liquid dries out.

Walls, ceilings, woodwork and metalwork are painted to

- provide a decorative appearance
- protect the surface from moisture penetration
- protect the surface from rusting.

A standard paint consists of

- thinners
- pigments
- binders.

3.2 Floor Finishes

Floor finishes are usually applied to a structural base but may form part of the floor structure as in the case of floor boards. Most finishes are chosen to fulfill a particular function such as:

Resistance to wear

Some parts of a building receive more use than others or are in closer contact with the dust or mud outside. The floor finish should match the type of wear that is normal in a specific part of a building so that it lasts many years without replacement.

Resistance to grease and oil

The floor should not be damaged by grease and oil spills and they should be easily wiped from the surface. Spills are a particular problem in kitchens

Resistance to water spills

The flooring in bathroom and kitchen needs to withstand water spills from washing or plumbing leaks.

Ease of cleaning

Surfaces that allow dirt to easily penetrate are harder to keep clean. If ease of cleaning is a priority then a hard smooth finish is better than a soft open texture.

Warmth or coolness

Hard smooth surfaces are cool to walk on because they conduct heat away. Soft textured finishes like carpet give a room a warmer feel which may be suitable for cooler climates.

Noise

Hard surfaces do not absorb sound so they are noisier than soft surfaces

Cost

The costs vary enormously for the higher range of finishes. The cheapest finish is a cement screed. The most expensive are carpet, wood block or special floor tiles.

Test Questions

1. Distinguish between plastering and rending
2. State 3 purposes for which paint is applied to a building

WEEK 12 FINISHES (CONTINUED)

Different types of floor finishes

The following are the most common types of floor finishes.

- Terrazzo tiles
- PVC
- Granolithic screeds
- Cement and sand screed
- Ceramic tiles finish
- Wood floor finish

Terrazzo tiles

The floor is floated once it has been soaked in ebonite (hardened PVC materials that is flexible to a limit) is laid in modules floor is then cast with thickness of 20 mm and a grinding machine is then used to grind the surface to finish after about 2-3 days of casting. The floor after grinding may be 19mm thick. Detergent or washing solvent is used to wash the surface after grinding. The surface is then polished to finish.

Terrazzo floors are laid by applying a 25 mm cement and sand screed which is followed by the cement and marble mixture (i.e. terrazzo) while the screed is still fresh.

An important feature of a terrazzo finish is the strip of metal, ebonite or plastic strips which go through the screed to the subfloor to divide it into bays. The purpose of the strips is to limit the bays to $1m^2$. This prevents shrinkage cracks and makes the floor finish particularly decorative if different colours of terrazzo are used.

Pre-cast terrazzo tiles

This is the one that is prepared in the workshop or factories and brought to site and laid in position. In the case of ebonite PVC, the gaps are filled with glamn. But we butter the bottom of the tile with thick cement only.

PVC tiles

The PVC tiles have precise measurements (300 x 300 x 3mm). They must be laid on a perfectly smooth screed because they are so thin and fixed with adhesive. However, they can be fitted so closely that they do not have a gap in the joints. PVC tiles are usually resistant to grease and oil, water proof and durable. Although they come in wide range of colours and textiles, PVC tiles are one of the cheapest floor finishes that one can buy and lay. They are maintained by applying a surface coating of wax and then washing with soapy water.

Granolithic screeds

This uses granite chippings in a cement and sand screed in 1:1:3 mixes to improve the wearing qualities. The granite chips are graded from 5mm to dust. This screed can be laid on fresh concrete so that it forms a 25mm monolithic bond in bays which are less than $10m^2$. If the screed is laid after the concrete is dry, then the thickness of the screed must be 40-50mm. The top of the granolithic screed must be leveled and compacted. It becomes firm when it sets. In this case you must smooth it with a steel trowel at least three times in a 6 hour period to produce a hard, dense surface without an accumulation of fine particles. The screed must be cured for seven days.

Cement and sand screed

This type of floor finish is laid if the concrete subfloor is not smooth or level enough for a floor finish. The screed consists of a layer of mortar, which provides a good surface when leveled with a steel trowel. The thickness of the mortar, which does not give any structural support, varies from 25 to 60 mm in a 1:3 cement and sand mix depending on the circumstances. As little water as possible is used to minimize shrinkage.

Ceramic floor tiles

This type of tiles is made from ceramics. This are product from refine natural clays which are pressed after grinding and tempering into the desired shape before being fire at high temperature. They are valuable in sizes ranging from 50 x 50 mm to

300 x 300 mm in thickness of 9.5mm to 13mm.They are laid on mortar beds. Some tiles have wide joints which have to be filled separately, while others are fitted so tightly that no joint

filling is needed.

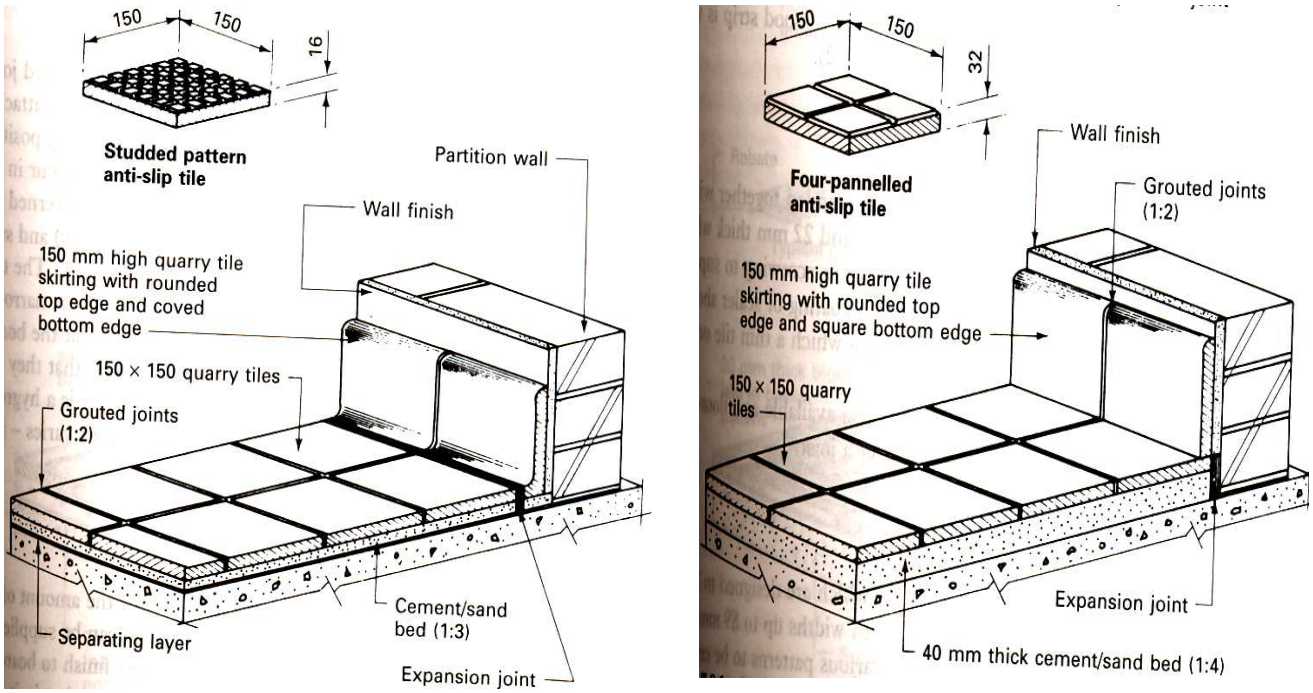


Fig 12.1 Typical ceramic floor tiles installation

Wood floor finish

The most common wood floor finishes are

- Wood mosaic
- Wood strip

Wood mosaic is a low-cost type of hardwood floor which uses off-cuts of hardwood. The wood is shaped into pieces 150 x 300 x10 mm and assembled into 300 x 300 x 10 mm panels. The panels are laid in groups of five in a basket weave pattern on a paper backing which holds them together while they are transported.

Each panel is laid separately on a completely dry cement and sand screed which is first of all cleaned of all loose materials. They panels are stuck on the screed with adhesive so that each panel fits tightly against the next. The installation is completed by removing the paper backing.

Wood strip

Wood strip flooring is made from timber strips in softwood or hardwood fixed to battens on concrete subfloor. The battens are secured by

- Casting galvanized metal clips into the concrete or screed.
- Casting dovetail battens into the screed so they are anchored as the screed dries.

The process is completed by sanding or polishing to a fine finish.

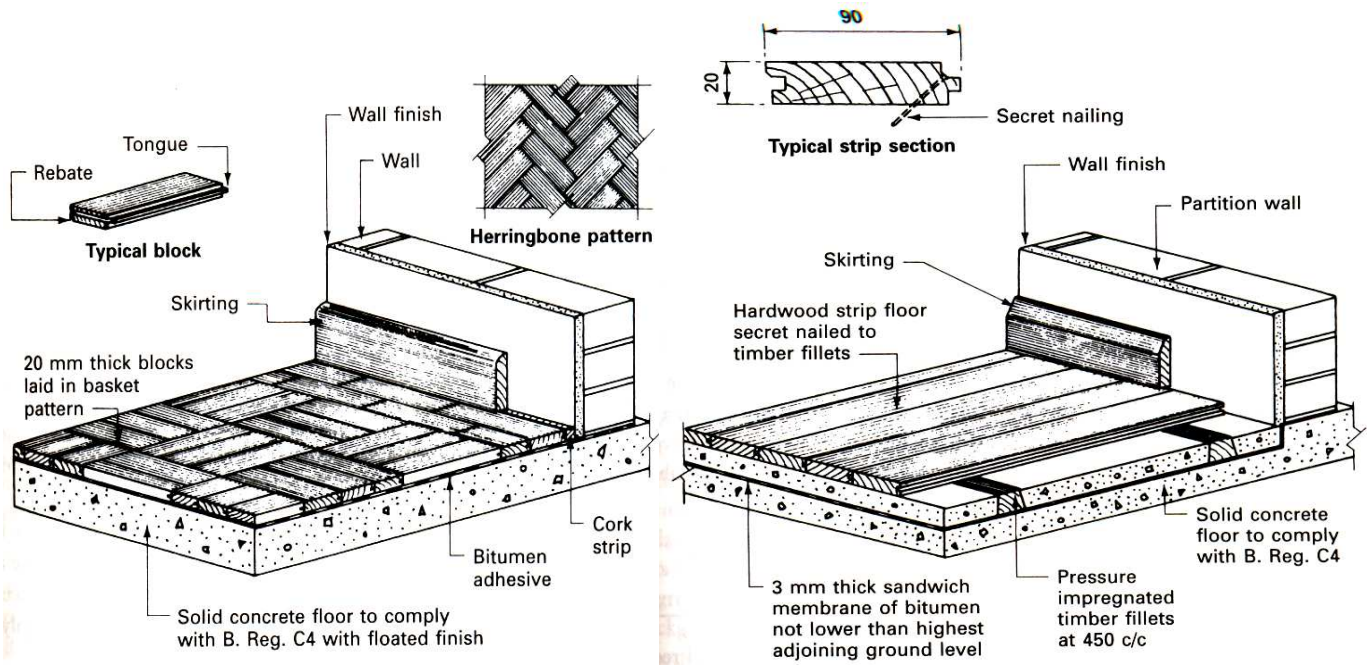


Fig 12.2 Wood strip flooring

Test questions

1. List 5 five common floor finish frequency in use.
2. Describe 3 of question ‘1’ above

WEEK 13 WALL AND CEILING FINISHES

3.3 Wall finishes

In wall finishes, the following can be applied

- Plastering
- Rendering
- Tiling

Applying a plaster finish

One, two or three coats of plaster may be applied to achieve a smooth finish. Generally, two coats need to be applied unless plasterboards are being used, in which case only one coat is needed. Three coats are only used if the surface is extremely uneven. The first coat in a three-coat finish, called a screed coat, is applied to level the surface and to ensure that the plaster is the correct thickness.

The background is first all prepared. Any depressions in the surface should be filled with mortar or neat plaster. A cement and sand mixture (1:3 combined with minimal water) is applied with a trowel. The sand should be well graded to reduce cracking from shrinkage after the plaster dries. Before the first coat fully sets, it should be scratched to provide a key for the second coat and leave to dry. A finishing coat of neat plaster is then applied with a steel float to produce a thick, smooth finish.

External rendering

Several finishes and textures are common to external rendering such as; Smooth render, roughcast render, scraped render, pebbledash render, Tyrolean render to improve the appearance of cement and sand mix and help to control shrinking and cracking, which affects the waterproof quality of render.

Wall tiling

Tiles are made from clays with special additives. Common sizes for wall tiles are

- 150 x 150 x 5-6 mm
- 100 x100 x4-5 mm

Their shapes and sizes may vary, but the method of fixing and pointing are the same for all tiles.

On an even surface, tiles are fixed using the thin bed method using a special adhesive 1-2 mm thick to fix thin tiles to a smooth surface such as plaster. It can only be used on smooth surfaces since the adhesive is the only anchor for the tiles.

On an uneven surface, the thick bed method is used to fix the wall tiles. A 1:4 cement sand mortar is prepared and spread over a wall as a wet bed to push the tiles into. Battens of the same thickness as the tiles and mortar bed can be nailed to the wall to act as a guide to the finished levels.

3.3 Ceiling finishes

The soffit of reinforced concrete slab that forms the ceiling should be level if the formwork was well built. If the surface is very uneven, then you will need to apply three coats of plaster. The first coat is the render coat, which creates a level surface with screeds. It should be about 10 mm thick. The second coat called the float coat should be 6 mm thick, and the ceiling should be finished off with a final 2 mm coat of neat plaster.

Plasterboards can make good ceilings timber suspended floors or pitched timber roof. The boards are fixed so that their lengths are at right angles to the floor joist or ceiling joists at 400 mm centres. The boards are usually large and heavy; about 2400 x 1200 mm and weigh 25 kg. Boards nailed at 150 mm centres along the lines of the joists. The joints at the ends of the boards should be under a joist, which may require cutting to fit. The process is finished by binding and filling the joints before applying a skim coat of plaster.

Painting of ceiling

Ceilings are painted to make it attractive, protect the surface from moisture penetration and rust. The following steps are taken in the plastering of ceilings.

- Remove all plaster splashes with a scraper
- Fill in and rub down any holes, scratches or grooves
- Remove dust with a soft brush

- Dilute the emulsion with 10 per cent additional water and paint it on as a priming coat.
- Leave it about an hour
- Apply the full-strength emulsion
- Leave it for 2 or 3 hours
- Paint on the final coat of emulsion.

Test Questions

1. Describe how plaster work is carried out
2. Describe painting on ceiling finishes

WEEK 14 PAINTING

3.4 Painting

After walls and ceiling are plastered or rendered smooth it might be necessary to finish the surface finally with painting.

Composition of paints

The actual composition of any paint can be complex but the basic components are-

- **Binder**- This is the liquid vehicle or medium which dries to form the surface film and can be composed of linseed oil, drying oils, synthetic resin and water. The first function of a paint over the surface and at the same time acting as a binder to the pigment
- **Pigment**- This provides the body colour, durability and corrosion protection of the paint. White lead pigments are very durable and moisture resistant but are poisonous and their use is generally restricted to priming and undercoating paint.
- **Solvents and Thinners**- These are the material that can be added to paint to alter its viscosity.

Types of paint

The main types of paints are:

- Emulsion paint
- oil paint (do not contain thinner)
- Hard gloss paint
- Enamel and synthetic paint

Characteristics of the Various Types of Paint

1. **Emulsion paint**- The typical emulsion paint is a synthetics resin e.g. Polyvinyl Acetate (P.V.A), emulsified in water, but other emulsified binders are oil. Oil vanishes resin, rubber and bitumen.

   Other ingredients are usually stabilizers which prevent coagulation. The drying action of this paint is that, their paint film are initial & sometime permanent, permeable which makes some suitable for decorating new plaster and other damp surface since background

moisture can be dried out through the paint film.
There hardening film are unstable which prove with age.

2. **Water paint-** Water paint has a medium composed of a drying oil. Oil varnishes or synthetic or natural resin emulsified in water usually together with a stabilizer such as glucine or casine. Water paints are in fact emulsion paints. Although they are not classified as that commercially. Pigment and Extender are added, and the product is usually supplied in the paste form. Mixed with water to be thinned by the user to the texture required for application. They give permeable paint film which is washable when hard and most are unaffected by alkalis. They are used mainly for interior decoration but some are suitable for external used.

3. **Distempers-** This differs from water paint in that they do not contain drying oil on resin. And they are not emulsified. They consist of a pigment and extenders with a water soluble binder such as glucine and are applied in mixed powder form or in paste form in water. Therefore they are prepared for use. Distempers are only used in the interior and they are also known as non-washable

4. **Oil Paint-** This have a wheel consisting of drying oil mixed with a thinner, they are classified by the group base on linseed oil with white spirit which constitute the already mixed oil based paint but other natural and synthetic oil and thinner are also used. These are available in priming, undercoat and finishing grades. The later can be obtained in a wide range of colours and finishes such as matt. Semi-matt, eggshell, satin, gloss and enamel, polyurethane paints have a good hardness and resistance to water and clearing. Oil based paint are suitable for most applications if used in conjunction with correct primer and undercoat.

5. **Hard Gloss-** They have a vehicle of special treated oil varnish or drying oil (with or without resin) mixed with a thinner, they are capable of giving a better gloss than ordinary oils paints & are more rapid in drying. They can be used externally although their durability can not be compared to that of a good quality oil paint

Functions of Paint

The main functions of paint are to provide

- An economic method of surface protection to building materials and components.
- An economic method of surface decoration to building materials components.

Test Questions.

1. Discuss three composition of paint
2. Describe the following types of paint
    i) Emulsion paint
    ii) Gloss paint
    iii) Enamel paint

WEEK 15 PAINTING (CONTINUED)

Application of paint

Paint can be applied by the following methods-

- **Brush**- The correct type, size and quality of brush such as those recommended in BS 2992 needs to be selected and used. To achieve a first class finish by means of brush application required a high degree of skill.
- **Spray**- as with brush application a high degree of skill is required to achieve a good finish. Generally compressed air spray or airless sprays are used for building works.
- **Rolling**- simple and inexpensive method of quickly and cleanly applying a wide range of paints to flat and textured surfaces. Roller heads vary in size from 50 to 450 mm wide with various covers such as sheepskin, synthetic pile fibres, mohair and foamed polystyrene. All paint applicators must be thoroughly cleaned after use.

Painting operation

The main objectives of applying coats of paint to a surface are preservation, protection, and decoration to give a finish which is easy to clean and maintain. To achieve these objectives the surface preparation and paint application must be adequate. The preparation of neat and previously painted surfaces should ensure that prior to painting the surface is smooth, clean, dry and stable.

Basic Surface Preparation

The basic surface preparation needs to be carried out for painting operation to serve its purpose well. The preparation depends on the surface to be painted.

Timber: to ensure a good adhesion of the paint film all timber should have a moisture content of less than 18%. The timber surface should be prepared using an abrasive paper to a smooth surface brushed and wiped free of dust and any grease removed with a suitable spirit. The stopping and filling of cracks with putty or appropriate filler should be carried out after the application of the priming coat. Each coat of paint should be smoothened with fine abrasive paper after it has hardened before the next coat is applied.

Building boards: most building boards do not require any special treatment except for the

application of a sealer as specified by the manufacturer.

Iron and Steel: the preparation here includes removing all rusts, mill scale, oil, grease and wax. This can be achieved by wire brushing, using mechanical means such as shot blasting, flame cleaning and chemical processes and many of these processes are often carried out in the fabrication works prior to shop applied priming.

Plaster: the essential requirement of the preparation is to ensure that the plaster surface is perfectly dry, smooth and free of defects before applying any coats of paint especially when using gloss paints. Plaster which contains lime is alkaline and such surfaces should be treated with an alkali resistant primer when the surface is dry before applying the final coats of paint.

Paint defects

This may be due to poor and incorrect preparation of the surface; poor application of the paint and/or chemical reactions. The general remedy is to remove all the affected paint and carryout the correct preparation of the surface before applying in the correct manner new coats of paint. Most paint defects are visual and therefore remedial treatment is undertaken.

Typical Paint Defects

- **Bleeding**- Staining and disruption of the paint surface by chemical action. Usually caused applying an incorrect paint over another. Remedy is to remove affected paint surface and repaint with correct type of overcoat paint.
- **Blistering**- usually cause by poor presentation allowing resin or moisture to be entrapped. The subsequent expansion causing the defect. Remedy is to move all the coats of paint and to ensure that the surface is dry before repainting.
- **Blooming**- mistakes usually on high gloss or varnished surfaces due to the presence of moisture during application. It can be avoided by not painting under these conditions. Remedy is to remove affected paint and repaint.
- **Chalking**- powdering of the paint surface due to natural ageing or the use of poor quality paint. Remedy is to remove paint if necessary. Prepare surface and repaint
- **Cracking and Crazing**- usually due to unequal elasticity of successive coats of paint.

Remedy is to remove affected paint nd repaint with compatible coats of paint.

- **Flaking and Peeling**- can be due to poor adhesion, presence of moisture. Painting over unclean areas or poor preparation. Remedy is to remove affected paint, prepare surface and repaint.
- **Grinning**- due to poor quality of paint film allowing paint coat below or background to show through, could be the result of poor application. Incorrect thinning or the use of the wrong colour. Remedy is to apply further coats of paint to obtain a satisfactory surface.
- **Soponification**- formation of soap from alkali present in or on surface painted, the paint is ultimately destroyed and a brown liquid appears on the surface. Remedy is to remove the paint films and seal the alkaline surface before repainting.

Test Questions

1. Describe three method of paint application
2. List and discuss four types of paint defect