
UNIT 12

LINTELS, ARCHES AND SCAFFOLDING

Structure

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12.0 INTRODUCTION

Openings are invariably left in the wall for the provision of doors, windows, cupboards, almirahs, wardrobes, etc. These openings are bridged by the provision of either a *lintel* or an *arch*. Thus, both lintels as well as arch are structural members designed to support the loads of the portion of the wall situated above the openings, and then transmit the load to the adjacent wall portions (jamb) over which these are supported. In this unit, we shall discuss lintels and arches, their types and material used for their construction.

We shall also discuss about *scaffolding*, which is a temporary structure constructed of timber or steel framework when the height of wall or column or other structural member of a building exceeds about 1.5 m. These temporary structures are needed to support the platform over which the workmen can sit and carry on the constructions.

12.1 OBJECTIVES

After studying this unit, you should be able to understand and familiarize:

- describe lintels and their types,
- explain arches, various terms associated with an arch, and different types of arch,
- discuss stability of an arch and construction of arches, and
- describe scaffolding, its components and its different types.

12.2 LINTEL

A *lintel* is a horizontal member, which is fixed over the opening, viz., doors, windows recesses, etc. to support the structure over the opening. Lintels are thus a sort of rectangular beam which afford facilities for fixing the door and window frames, wherever they are used. Lintels may be made of several materials such as wood, stone, brick, reinforced brickwork, reinforced concrete or rolled steel sections embedded in cement concrete.

The width of lintel should be equal to the width of the wall. A proper bearing of lintel ends on supports is very essential. As a general rule, the bearing of the lintel at its ends should be either 10 cm or 4.0 cm for every 30 cm of span, whichever is greater. For very long spans, the bearing to the lintel ends should at least be equal to the depth of the lintel. Further, as a rule, the depth of the lintel can be adopted as $1/12^{\text{th}}$ of the span or 15 cm whichever is greater. The depth can be adjusted to course heights of brick or stone. The lintels should be strong enough to resist failure due to the forces of compression, tension and shear.

12.3 CLASSIFICATION OF LINTELS

Lintels are classified into the following types, according to the materials of their construction:

- a. Wooden lintels
- b. Stone lintels
- c. Brick lintels
- d. Reinforced concrete lintels
- e. Steel lintels

Wooden Lintels: Wooden lintels are oldest types of lintels. These lintels are not very common except in hilly areas. Wooden lintels are relatively costlier, structurally weak and vulnerable to fire. They are also liable to decay if not properly ventilated. Figure 12.1 shows a wooden lintel provided over the full width of the wall, by jointing together three wooden pieces with the help of steel bolts. Sometimes, wooden lintels are strengthened by the provision of mild steel plates at their top and bottom, such lintels are called *fitched lintels*.

Stone Lintels: A stone lintel consists of a simple stone slab of greater thickness. Stone lintels can also be provided over openings in brick walls. Stone lintels are the mostly used at the places, where stone is abundantly available. Dressed stone lintels give good architectural appearance.

Stone lintels are constructed of slabs of stones of sufficient length without flaws either in single piece or combination of more pieces. The thickness of the stone lintel should be 80 cm, or 4 cm for every 30 cm span, whichever is more. Stone is very weak in tension. Also, it cracks if subjected to vibratory loads. Hence stone lintels should be used with caution where shock waves are quite common.

Brick Lintels: For openings lesser than 1 m and for lighter loads, lintels made from bricks are used. These are not very strong from structural point of view. A brick lintel consists of bricks placed on end or edge, as shown in Figure 12.3. The depth of brick lintel varies from 10 to 20 cm, depending upon the span. It is constructed over temporary wooden centering. The bricks with frogs are more suitable for the construction of lintel, since the frogs, when filled with mortar, form joggles which increase the shear resistance of end joints. Such lintel is known as *joggled brick lintel*.

Reinforced Brick Lintel: Reinforced brick lintels are constructed at places where loads are heavy, or span is more. The depth of such lintel is kept equal to 10 cm, or in multiple of 10 cm. Sometimes, a 15 cm thick brick lintel may be obtained by using 5 cm thick tiles in conjunction with 10 cm thick bricks. Alternatively, bricks can be placed on edge. The bricks are so arranged that 2 to 3 cm

wide space is left length-wise between adjacent bricks for the insertion of reinforcement of mild steel bars and the gap is filled with cement mortar. Vertical shear stirrups of 6 mm diameter wire are provided in every third vertical joint.

Main reinforcement having 8 to 10 mm diameter bars are provided at the bottom of the lintel.

Steel Lintels: Where the opening is large and the super-imposed loads are heavy, lintels made from steel are used. This type of lintel consists of rolled steel joists or channel sections either used singly or in combination of two or three units. When a single joist is used, it is either embedded in concrete, or clad with stone facing, so as to increase its width to match with the width of the wall. When more than one unit is placed side by side, they are kept in position by pipe separators (Figure 12.5).

Reinforced Cement Concrete Lintels: Reinforced cement concrete lintels are the most commonly used these days. They have replaced all other types of lintels because of their strength, rigidity, fire resistance, economy and ease in construction. These can be used on any span. Its width is kept equal to the width of the wall. The depth of RCC lintel and the reinforcement depends upon the span and the magnitude of loading. Longitudinal reinforcement, consisting of mild steel bars are provided near the bottom of lintel to take up tensile stresses. Half these bars, are however cranked up near the ends. Shear stirrups are provided to resist transverse shear. A typical RCC lintel is shown in Figure 4.6. RCC lintel over a window, along with a chhajja projection is shown in Figure 12.7. Formwork is required for construction of cast in-situ lintels. RCC lintels are also available as pre-cast units.

12.4 ARCH

An arch is a structure constructed of wedge-shaped units (bricks or stone), jointed together with mortar and spanning an opening to support the weight of the wall above it along with other super-imposed loads. Due to wedge-like form, the units support each other, the load tends to make them compact and enables them to transmit the pressure downwards to their supports.

In common with lintels, the function of an arch is to carry the weight of the structure above the opening. Lintels are simple and easy to construct, while special centering formwork is required for the construction of an arch. However, arches are constructed where loads are heavy, span is more, strong abutments are available and special architectural appearance is required.

12.4.1 Technical Terms

Most of the technical terms generally used in connection with the arch work are illustrated in Figure 4.8 and are briefly described below:

Abutment: This is the end support of an arch.

Pier: This is an intermediate support of an arcade.

Intrados: This is the inner curve of an arch.

Soffit: It is the inner surface of an arch. Sometimes, intrados and soffit are used synonymously.

Extrados: It is the upper or external curve of an arch.

Voussoirs: These are wedge-shaped or tapered units of bricks, stones or concrete works, forming the courses of an arch.

Crown: It is the highest part of extrados of an arch.

Key: It is the wedge-shaped unit fixed at the crown of the arch.

Spandril: This is a curved-triangular space formed between the extrados and the horizontal line through the crown.

Skew Back: This is the inclined or splayed surface on the abutment, which is so prepared to receive the arch and from which the arch springs.

Springing Points: These are the points from which the curve of the arch springs.

Springing Line: It is an imaginary line joining the springing and points of either end.

Pringer: It is the first voussoir at springing level; it is immediately adjacent to the skewback.

Arcade: It is a row of arches supporting a wall above and being supported by piers.

Haunch: It is the lower half portion of the arch between the crown and the skew-back or springer.

Ring: It is a circular course forming an arch. An arch may be made of one ring or more than one ring.

Impost: It is the projecting course at the upper part of a pier or abutment to stress the springing line.

Bed Joints: These are the joints between the voussoirs, which radiate from the center.

Centre or Striking Point: This is the geometrical center point from where the arcs forming the extrados, arch rings and intrados are described or struck.

Span: It is the clear horizontal distance between the supports or springing points.

Rise: It is the clear vertical distance between the springing line and the highest point on the intrados.

Depth or Height: It is the perpendicular distance between the intrados and extrados.

Thickness (or Breadth of Soffit): This is the horizontal distance measured perpendicular to the front and back faces of an arch.

12.4.2 Stability of an Arch

The stability of an arch depends on the friction between the surfaces of wedge-shaped blocks called voussoirs and the cohesion of mortar. Every element of arch remains in compression. It has also to bear transverse shear. An arch may, therefore, fail in the following ways:

- a. Crushing of the arch material.
- b. Sliding of wedge-shaped blocks or voussoirs.
- c. Rotation or overturning of some joint about an edge.
- d. Differential settlement of supports or abutment/pier.

If the compressive stress or thrust exceeds the safe crushing strength of the materials, the arch will fail in crushing. Hence, the material used for construction should be of adequate strength, and the size of voussoirs should be properly designed to bear the thrust transmitted through them. For small spans, the thickness of the arch ring is kept uniform from crown to the springing. As a rule, the thickness of the ring may be taken either 1/12th the span or as follows (for brickwork in cement mortar, 1 : 4). For span up to 1.5 m – 20 cm; spans between 1.5 to 4 m – 30 cm; spans between 4 to 7.5 m – 40 cm, for span more than 7.5 m, the thickness at springing may be increased by about 20% of the thickness at the crown. For arch work, only first class blocks should be used, and in case of large spans, the arches may be strengthened by steel reinforcement, so that the safe crushing strength is not exceeded.

Sometimes, voussoirs of variable heights are provided with less height near crown and more height at skew-back. To safeguard against sliding of voussoirs past each other due to transverse shear, the voussoirs of greater height should be provided. Also, the angle between the line of resistance of the arch and the normal to any point should be less than angle of internal friction. To prevent *Rotation*, the line of resistance is kept within intrados and extrados and the line of resistance or thrust should be made to cross the joint away from the edge to height. The differential settlement of abutment may cause secondary stresses in the arch. Hence the abutment, which has ultimately to bear all the loads transferred to it through the arch, should be strong enough. Also, the arch should be symmetrical, so that unequal settlements of the two abutments is minimized.

12.5 CLASSIFICATION OF ARCHES

An arch can be classified according to

- a. shape formed by soffit or intrados,
- b. number of centers,
- c. workmanship, and
- d. materials of construction.

Classification according to Shape by Soffit or Intrados

According to this classification, arches may be of the following types:

Flat Arch: A flat arch has usually the angle formed by skewbacks as 60° with horizontal, thus forming an equilateral triangle with intrados as the base. The intrados is apparently flat, but it is given a slight rise of camber of about 10 to 15 mm per meter width of opening to allow for small settlements. However, the extrados is kept horizontal and flat. Flat arches are used only for light

loads, and for spans up to 1.5 m. The depth of the arch is generally kept equal to three or four courses of the brick.

Segmental Arch: This is the common type of arch used for buildings. The center of arch lies below the springing line. The bed joints of the voussoirs radiate from the center of the arch. The depth of segmental arches may be 20 cm, 30 cm or any multiple of half bricks according to the class of work, width of opening etc. The thrust transferred to the abutment is in an inclined direction.

Semi-circular Arch: The shape of the arch soffits is a semi-circle and hence named semi-circular arch. This is the modification of segmental arch in which the center lies on the springing line. The thrust transferred to the abutments is perfectly in vertical direction since the skewback is horizontal.

Horse Shoe Arch: The arch has the shape of a horseshoe, incorporating more than a semi-circle. Such type of arch is provided mainly from architectural considerations.

Pointed Arch: This pointed arch is formed by the intersection of curves at the apex or crown. It consists of two arcs of circles meeting at the apex or crown. Because of the style of architecture, it is also known as Gothic arch. There are five forms of pointed arch viz., drop, equilateral, lancet, Tudor and Venetian arch.

Venetian Arch: This is another form of pointed arch which has deeper depth at crown than at springing. It has four centers, all located on the springing line.

Florentine Arch: This is similar to venetian arch except that the intrados consists of a semi-circular curve. The arch has, thus, three centers, all located on the springing line.

Relieving Arch: This arch is constructed either on a flat arch or on a wooden lintel to provide greater strength. The ends of the relieving arch should be carried sufficiently into the abutments. The relieving arch makes it possible to replace the decayed lintel later, without disturbing the stability of the structure.

Stilted Arch: It consists of a semi-circular arch with two vertical portions at the springing. The center of the arch lies on the horizontal line through the tops of the vertical portions.

Semi-elliptical Arch: This type of arch has the shape of a semi-ellipse and may have either three centers or five centers.

Classification Based on Number of Centers

On the basis of number of centers, the arches may be classified as:

One-centered Arches: These arches have one center only. Segmental arches, semi-circular arch, flat arches, horse-shoe arch and stilted arches come under this category. Sometimes, a perfectly circular arch, known as bull's eye arch as shown in Figure 4.10(a), is provided for circular windows.

Two-centered Arches: These arches are of several types but the popular ones are pointed arches and Florentine arch as shown in Figures 4.9(e) and (g).

Three-centered Arches: Elliptical arches come under this category. Figure 4.10(b) shows a three-centered arch.

Four-centered Arch: It has four centers. Venetian arch is a typical example of this type. Another examples are the Tudor arch as in Figure 4.10(c).

Five-centered Arch: This type of arch, having five centers, gives a good semi-elliptical shape as is shown by Figure 4.10(d).

Classification Based on Material and Workmanship

On the basis of material of construction and workmanship, arches may be classified as follows:

Stone arches: Rubble arch, ashlar arch.

Brick Arches: Rough arch, axed or rough-cut arch, gauged arch and purpose made arch.

Concrete Arches: Concrete block units' arch, monolithic arch.

A brief description of the above types is given below.

Stone Arches: Depending upon workmanship, stone arches are of two types:

Rubble Arches: These arches are made of rubble stones which are hammer dressed, roughly to shape and size of voussoirs of the arch and fixed in cement mortar. In this type, all the stones used may not be of the same size and hence joints formed are thicker. Rubble masonry arch is comparatively weak and is used for comparatively inferior work. Rubble arches are used up to spans of 1 m. They are also used as relieving arches, over wooden lintels. Up to a depth (thickness) of 40 cm, these arches are constructed in one ring. For greater depths, rubble stones are laid in two rings in alternate course of headers and stretchers.

Ashlar Arches: In this type, the stones are cut to proper shape of voussoirs, and are fully dressed, set in lime or cement joints with proper bed joints. Up to depth of 60 cm, the voussoirs are made of full thickness of the arch. Ashlar arches have a good appearance and are used for superior work. Figure 4.11 shows some details of semicircular, segmental and flat arches of ashlar stones.

Brick Arches: Brick arches may be classified as rough brick arches, axed or rough cut brick arches, gauged brick arches and purpose made brick arches, depending upon the nature of workmanship and quality of bricks used.

Rough Brick Arches: This type of arch is constructed with ordinary bricks, which have not been wedge-shaped and consequently the joints formed are wider at the extrados than the intrados. Due to this, the appearance of the arch is spoiled. Therefore, this type of arch is not used for exposed brick work.

Axed Brick Arches: In this arch, the ordinary bricks are roughly cut with a brick layer axe to form wedge-shaped voussoirs. Due to this the joints are of uniform thickness (3 to 6 mm) along the radial line. However, the appearance of the arch is not very pleasant because the bricks cut to wedge-shapes are not finely dressed.

Gauged Brick Arch: This type of arch is constructed of bricks, which are prepared to exact size, and shape of voussoir by cutting it by means of wire saw. The surfaces of the bricks are fine dressed with the help of a file. For this, only soft brick (called *rubber bricks*) are used. The joints formed in gauged brick arch are fine, thin (1 to 1.5 mm) and truly radial. Lime putty is used for jointing. Figure 4.13(a) shows a gauged brick flat arch while Figure 4.13(b) shows gauged bricks semi-circular arch.

Purpose Made Bricks Arch: In superior type of arch work, the purpose-made bricks are used to get still fine and thin joints. For this work, putty lime (i.e. pure slacked lime) is used for binding the blocks.

Concrete Arches

Concrete arches are classified into two classes viz., pre-cast concrete block arches and monolithic concrete arches.

Pre-cast Concrete Block Arches: For small openings in a building, arches are made from pre-cast concrete blocks, each block being cast in the mold to the exact shape and size of voussoirs. Special molds are prepared for voussoirs, key block and skewbacks. Because of exact shape and size of blocks, good appearance of the arch is achieved. Also, joints, made of cement mortar, are quite thin. However, casting of blocks is costly, and such work is economical only when the number of arches is quite large. Cement concrete of 1 : 2 : 4 mix is usually used.

Monolithic Concrete Arches: These arches are constructed for roofing of buildings, culverts and bridges. Monolithic concrete arches are constructed from cast-in-situ concrete, either plain or reinforced, depending upon the span and magnitude of loading. These arches are quite suitable for larger span. The arch thickness is 15 cm for arches up to 3 m span. Formwork is used for casting the arch, and is removed only when the concrete has sufficiently hardened and gained strength. The curing is done for 2 to 4 weeks.

12.6 CONSTRUCTION OF ARCHES

The construction of arches of all the types of materials (i.e. bricks, stones concrete) is carried out in three steps:

- a. Installation of centering or formwork for arches.
- b. Actual laying of arch work or course work.
- c. Striking or removal of centering or formwork.

Installation of Centering for Arches: The construction of arches is commenced at their springing points and is brought up uniformly towards the crown, where the key block is finally inserted and fixed. Centering is the temporary structure required to support brick, stone or concrete arch during its construction, till it has gained sufficient strength. The centering is installed in such a way that its upper surface corresponds with the intrados of the arch. For minor works, centering may be

made of mud masonry constructed to match with the inner soffit of the arch, and then plastered. This masonry is dismantled later when the arch has been constructed and cured.

The usual centering is made of timber or steel. Wooden centering is the simplest and cheapest, used for moderate span. It is easy to construct and easy to dismantle and it can be used several times. Figure 4.14 shows a thick wooden plank, with horizontal bottom and the upper surface shaped to the underside of the soffit. Such a plank is known as *center or turning piece*. Its width is normally 10 cm, and is supported on vertical timber posts called props, with wooden wedges to tighten or loosen the centering.

If the soffit is wider than 10 cm, two ribs, suitably spaced and suitably shaped at the top may be used. These ribs may be connected by 4×2 cm wooden section called *laggings*. At the ends, bearers, wedges and posts as shown in Figure 4.15 support the ribs. For very large spans and wider

soffits, a built up centering of cut wood ribs is used. The upper surface of the ribs is given the shape of the soffit of the arch. Laggings (or cross-battens) are nailed across the ribs at close intervals to support the voussoirs at its top. Ribs are kept 25 to 40 mm thick, with width varying from 20 to 30 cm. The distance between ribs depends upon the thickness of the wall supporting the arch. Braces and struts to strengthen them connect the ribs. Horizontal ties are provided at the lower ends of the ribs to prevent them from spreading. The ribs are supported on bearers, and a pair of folding wedges is provided at the top of each prop to tighten or loosen the centering (Figure 12.16).

Actual Lying of Arch Work: After the erection or installation of centering, skewbacks are first prepared to receive voussoirs. Voussoirs are then arranged in proper and required forms, starting from skewbacks and proceeding towards the crown. Finally, key-stone is inserted so that all the voussoirs are locked in position. The voussoirs are bedded or laid in definite courses in sequence with radial joints to ensure strength and stability of the arch.

Striking or Removal of Centering: The centering used for construction of arches should be removed, only when the arch has developed sufficient strength. The centering must be eased two days before its removal so that the voussoirs may close in and compress the mortar, but the centering must be completely removed before any masonry is constructed on the top of the arch. It is essential because the removal of centering after the masonry construction may cause a small settlement of the arch, which in turn, may cause cracks in arch masonry and hence structural weakness. No load should be placed on the arch unless the centering has been removed.

For small spans, loosening the folding wedges does the removal of centering. When the span is more than 7.5 m, using sand boxes under the centering trusses, to avoid shocks, does lowering and removal of centering. A sand box, shown in Figure 4.17, is placed below the prop. Sand is filled in box with a plugged hole at its bottom. Prop rests on the steel plate placed on the top of sand. In order to lower the centering, plug is taken out due to which the sand flows out and lowers the prop gradually.

12.7 SCAFFOLDING

When the height of wall or column or other structural member of a building exceeds about 1.5 m, temporary structures are needed to support the platform over which the workmen can sit and carry on the constructions. These temporary structures, constructed very close to the wall, are in the form of timber or steel framework, commonly called *scaffolding*. Such scaffolding is also needed for the repairs or even demolition of a building. The scaffolding should be stable and should be strong enough to support workmen and other construction material placed on the platform supported by the scaffolding. The height of the scaffolding goes on increasing as the height of construction increases, as shown in Figure 4.18.

Scaffolding has the following components:

Standards: These are the vertical members of the framework, supported on the ground or drums, or embedded into the ground.

Ledgers: These are horizontal members, running parallel to the wall.

Braces: These are diagonal members fixed on standards.

Putlogs: These are transverse members, placed at right angles to the wall with one end supported on ledgers and other end on the wall.

Transoms: These are those putlogs whose both ends are supported on ledgers.

Bridle: This is a member used to bridge a wall opening, which supports one end of putlog at the opening.

Boarding: These are horizontal platform to support workmen and material; these are supported on the putlogs.

Guard Rail: This is a rail, provided like a ledger, at the working level.

Toe Board: These are boards, placed parallel to ledgers, and supported on putlogs, to give protection at the level of working platform.

Various components or members of the scaffolding are secured by means of rope-lashings, nails bolts etc.

12.8 TYPES OF SCAFFOLDING

Different types of scaffolding are given in the following table:

1.	Single Scaffolding or Bricklayer's Scaffolding	5.	Suspended Scaffolding
2.	Double Scaffolding or Mason's Scaffolding	6.	Steel Scaffolding and Centering

3.	Ladder Scaffolding or Patented Scaffolding	7.	Trestle Scaffolding
4.	Cantilever Scaffolding	8.	Wooden Gantries

Single Scaffolding (Bricklayer’s Scaffolding):

This is most commonly used in the construction of brickwork. In this type of scaffolding, most of the members except platforms are usually made of bamboos and poles. It consists of a single framework of standards, ledgers, putlogs etc., constructed parallel to the wall at a distance of about 1.20 meters. The standards are placed at 2 to 2.5 m interval. Ledgers connect the standards, and are provided at a vertical interval of 1.2 to 1.5 m. Putlogs are placed with one end on the ledgers and other end in the hole left in the wall, at an interval of 1.2 to 1.5 m. Guards, boarding and other members are placed as shown in Figure 4.18.

As the work proceeds, the platform is raised to higher levels by extending the standards by adding extra pieces, if necessary. The scaffolding will be removed after the pointing or plastering and whitewashing work is over. After removing the putlogs, the holes must be filled solid immediately. Such scaffolding is commonly used for bricklaying, and is also called *putlog scaffolding*.

Double or Mason’s Scaffolding: This type of scaffolding is stronger than the single scaffolding and it is used in the construction of stone work. In stone masonry, it is very difficult to provide holes in the wall to support putlogs. In that case, more strong scaffolding is used consisting of *two rows* of scaffolding. Each row thus, forms a separate vertical framework. The first row is placed at 20 to 30 cm away from the wall, while the other framework is placed at 1 m distance from the first one. Putlogs are then supported on both the frames. Rakers and cross-braces are provided to make the scaffolding stronger and stable. Such scaffolding is also called *independent scaffolding*.

Ladder Scaffolding or Patented Scaffolding: This is a modification over double scaffolding and can be easily assembled (Figure 4.20). Now-a-days, several patent ladder scaffoldings are available in the market. In this type, the working platforms are supported on brackets (with inner row of standards), which can be adjusted to any desired height. The various components of the scaffold are fastened to each other by means of bolts and screws.

Such patented scaffoldings are very suitable for light works such as exterior walls’ paintings and decoration. Sometimes, the ladder scaffolding is provided with additional cross-pieces which can be tied to windows for stability.

Cantilever or Needle Scaffolding: The use of this type of scaffolding becomes necessary where:

- a. it is not possible to fix the standards into the ground in the usual manner,
- b. the scaffolding is to be provided on the side of a busy street without obstructing the traffic on road, and
- c. the scaffolding is required for construction of upper storeys of a tall building.

In this, framework whether of single scaffolding type or double scaffolding type is supported by a series of cantilevers or needle beams (i.e., timber beams projecting from wall) passing through window openings or through holes in the wall. In Figure 12.21, two alternatives of supporting the projecting end are shown. In first alternative, the needles are supported at floor levels inside by means of plate and wedges, and outside projecting end is strutted to the window sills or cornices or string courses etc. In the second alternative (shown by dotted lines), the projecting beams are strutted inside on floors through the openings. The strut ends on floors are held in position by means of blocks or suitable devices. The joints between the inclined strut and the needle are clamped by means of dogs.

Suspended Scaffolding: This type of scaffolding is suitable for light steel frame construction as well as for maintenance works such as painting, pointing distempering, etc. In this type standards do not rest on the ground and hence scaffolding does not create any obstruction on the floor. The working platform is suspended from the roofs by means of wire ropes or chains. The mechanical arrangements are provided to raise or lower the platform to attain the optimum level for working.

Steel Scaffolding: Steel scaffolding is practically similar to timber scaffolding except that steel tubes replace wooden members and rope lashings are replaced by steel couplets or fittings. Such scaffolding can be erected and dismantled rapidly. It has greater strength, greater durability and higher fire resistance. Though its initial cost is more but its salvage value is higher. It is extensively used these days. Figure 12.22 shows steel scaffolding both for brick wall as well as stone wall.

Trestle Scaffolding: In this type, the working platforms are supported on the top of mobile devices, such as tripods, ladders, etc. mounted on bogies, wheels or lorries. Trestle scaffolding is suitable for minor repairs or painting work up to a maximum height of 5 m from the supporting level.

Wooden Gantries: In construction operations, where structural materials are beyond the capacity of manual handling, the gantries are used. Gantries are provided with lifting tackle to handle heavy construction blocks, stones and other materials.

A gantry usually consists of timber staging (though steel staging can also be used) for carrying a traveling crane and is made of squared timbers in a similar manner as the masons' scaffolding. But, in this type, only one row of standards on either side of the wall is provided. On the top of the standards, longitudinal pieces called runners are provided along the wall, over which cross-pieces known as rails are provided to carry the traveling platform. Traveling platform in turn carries a lifting tackle moving on the rails in a direction perpendicular to the length of the gantry. This lifting tackle finally delivers the construction units at the desired height.

12.9 SUMMARY

In this unit, we have studied about lintel, arches and scaffolding. Type of lintels and arches, type of scaffolding required for different stages of construction work is also discussed. We have also understood the necessity of lintels and arches in building construction and procedures for construction of lintels and arches. In the next unit, we will study different types of flooring.