BASIC MATERIALS OF CONSTRUCTION

Introduction:

All the building structures are composed of different types of materials. These materials are either called building materials or materials of construction. It is very essential for a builder, may be an architecture or engineer or contractor, to become conversant thoroughly with these building materials. The knowledge of different types of material, their properties and uses for different purposes provides and important tool in the hands of the builders in achieving economy in material cost. The material cost in a building ranges 30 to 50 percent cost of total cost construction. In addition to material economy, the correct use of material results in better structural strength, functional efficiency and esthetic appearance

STONES

Properties of Stones

1. **Crushing strength:** For a good building stone, the crushing strength should be greater than l000kg per cm^2.
2. **Appearance**: Good building stone should be a uniform colour, and free from clay holes, spots of other colour bands etc capable of preserving the colour for longtime.
3. **Durability**: A good building stone should be durable. The factors like heat and cold alternative wet and dry, dissolved gases in rain, high wind velocity etc affect the durability.
4. **Fracture**: For good building stone its fracture should be sharp, even and clear.
5. **Hardness**: The hardness greater than 17, treated as hard used in road works. It is between 14 to 17, medium hardness, less 14 said be poor hardness.

6. **Percentage wear**: For a good building stone, the percentage wear should be equal to or less then 3 percent.

7. **Resistance to fire**: A good building stone be fire proof. Sandstone, Argillaceous stone resists fire quite well

8. **Specific gravity**: For a good building stone the specific gravity should be greater then 8.7 or so.

9. **Texture**: A good building stone should have compact fine crystalline structure should be free from cavities, cracks or patches of stuff or loose material.

10. **Water absorption:** For a good building stone, the percentage absorption by weight after 24 hours should not exceed 0.60.

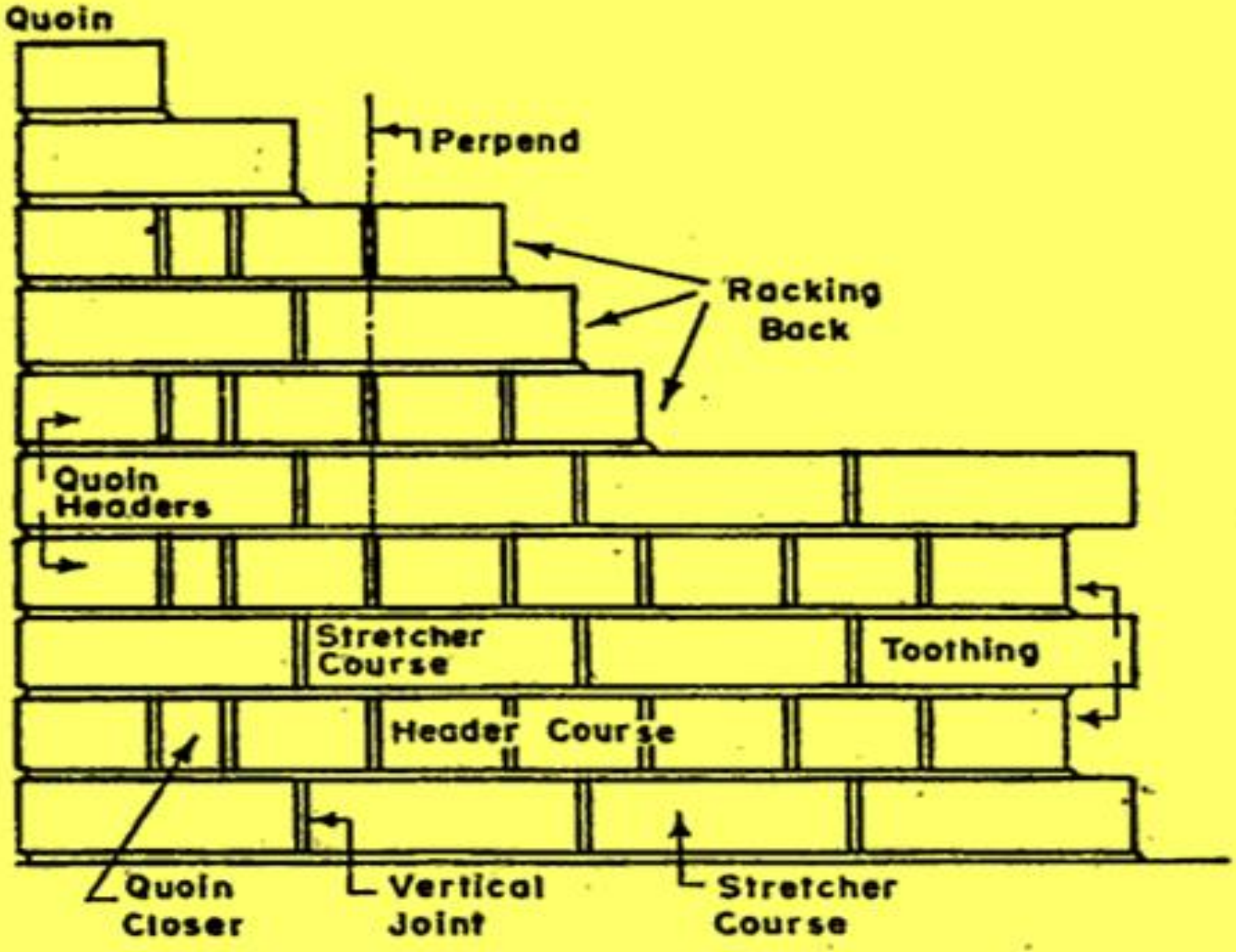
11. **Seasoning**: Stones should be well seasoned before putting into use. A period of about 6 to 12 months is considered to be sufficient for proper seasoning.

12. **Toughness Index**: Impact test, the value of toughness less than 13 – Not tough, between 13 and 19 – Moderate, greater than 19- high

Engineering Applications of Stones

1. Materials for foundation and walling of buildings, dams, bridges, etc.
2. Materials for road construction and concrete making in the form of broken or crushed stones.
3. Thin slabs for pavings.
4. Ornamental works.
5. Roofing tiles in the form of slates.
6. Lime stone for manufacture of cement.
7. Bindage for flooring and covering road surface.

BRICKS


Quoin
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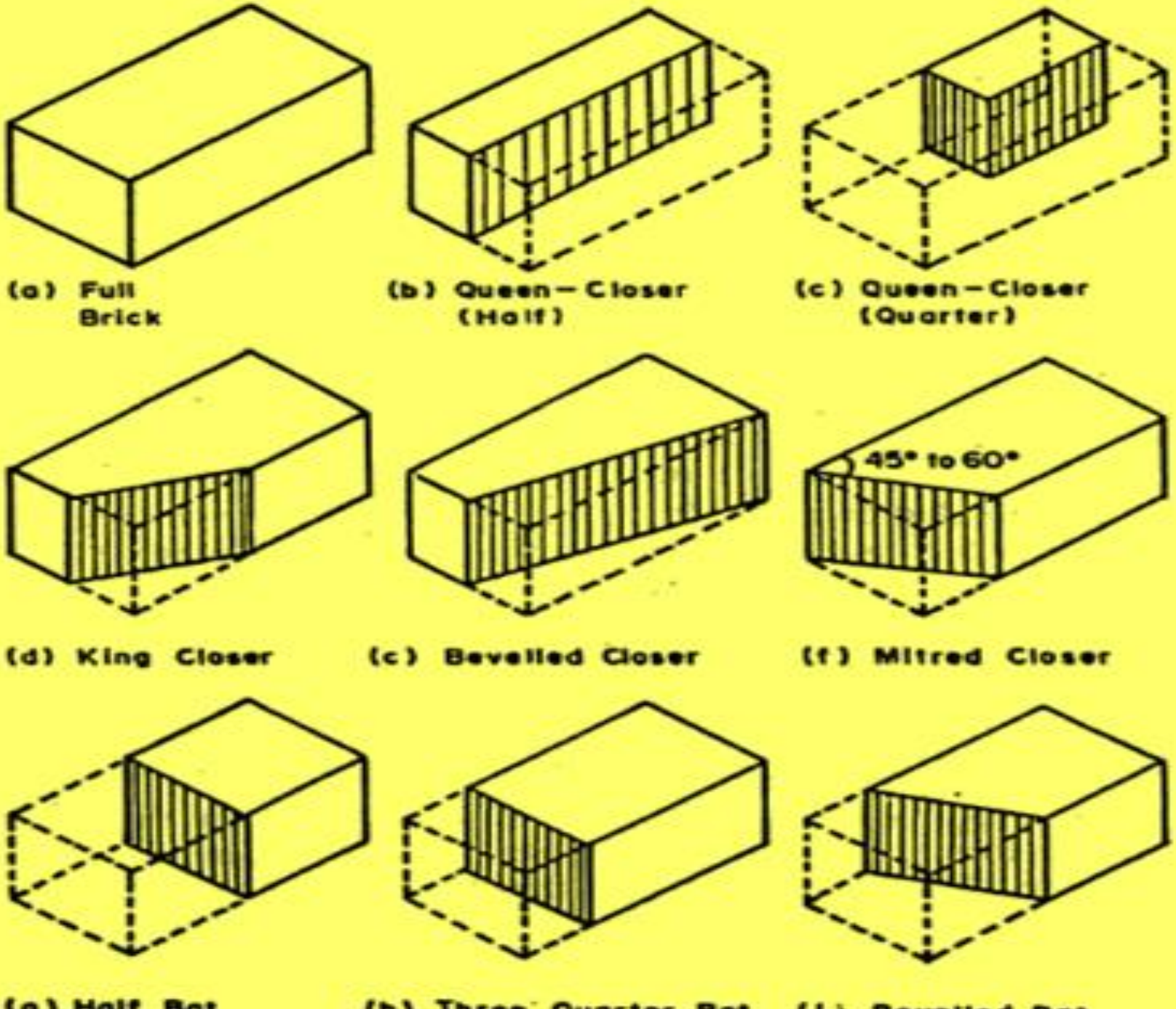


(a) Full Brick

(b) Queen – Closer (Half)

(c) Queen – Closer (Quarter)

(d) King Closer

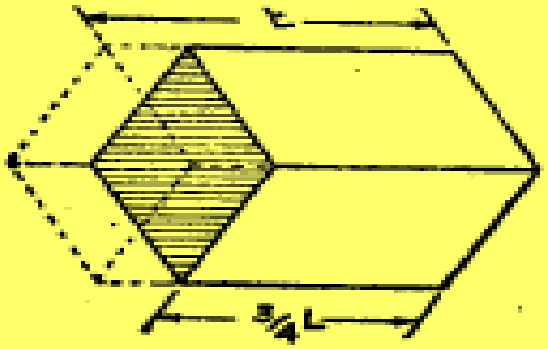
(e) Bevelled Closer

(f) Mitred Closer

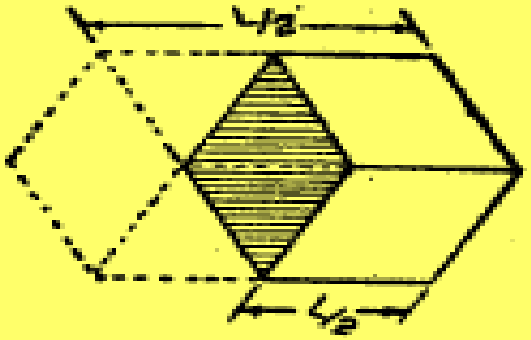
(g) Half Bat

(h) Three Quarter Bat

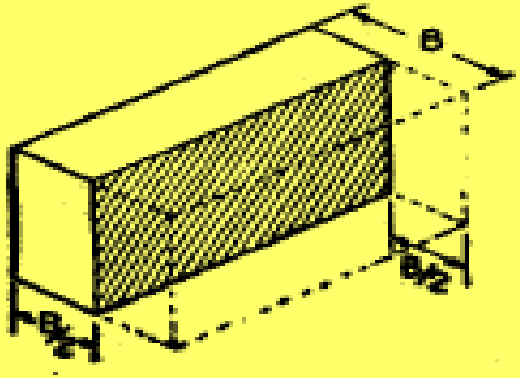
(i) Bevelled Bat



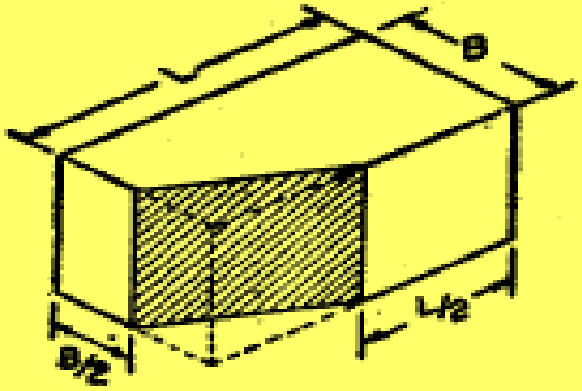
Three quarter Bat



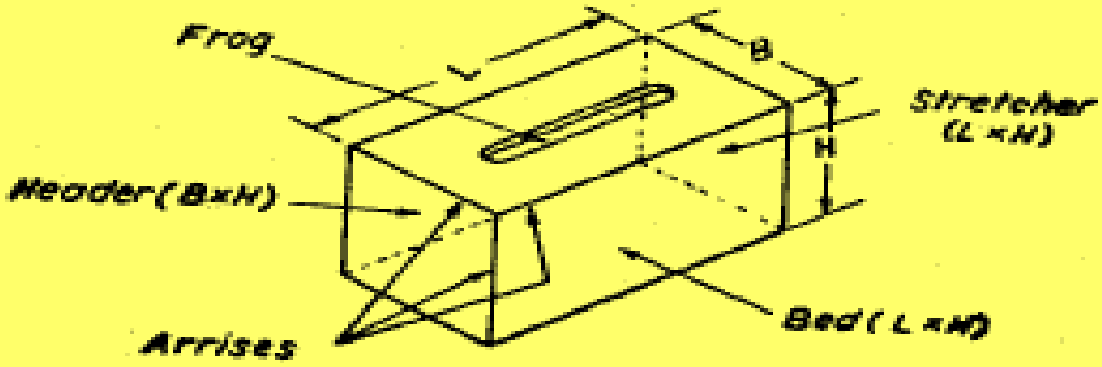
Half bat



Queen closer



King closer

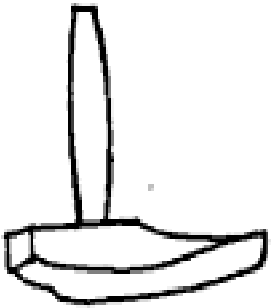


Full brick

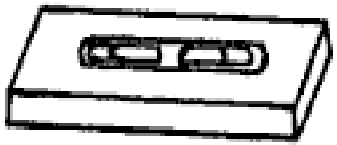
Commonly used tools in brick masonry

(a) Brick trowel

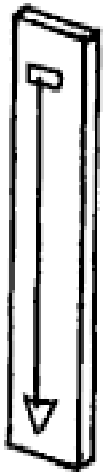
(b) Bolster



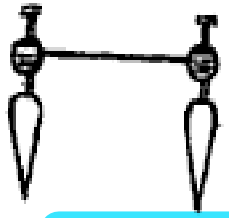
(c) Brick hammer



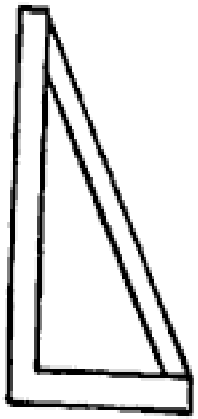
(d) Spirit level



(e) Plumb rule



(f) Line and pins

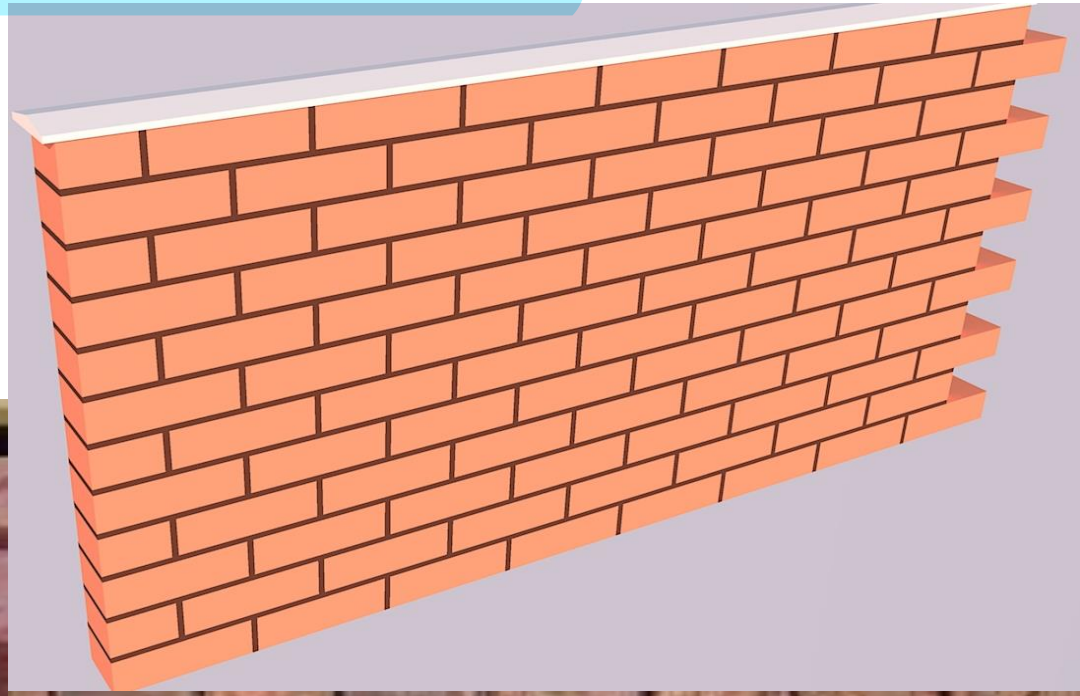


(g) Mason's square

Fig. 5.1 Commonly used bricklayer's tools.

Quality Wise Bricks are classified as:

- First Class Bricks
- Second Class Bricks
- Third Class Bricks



Brick is an old building material since a very long time. Brick is used to construct the building because of its good bearing capacity, long life, strength. Bricks are made up of blending a good clay and preparing a rectangular shape of uniform size and they are dried and burned. As bricks are in uniform size they can be beautifully laid in masonry work. It can also be carried to top of the building due to its low weight.

The bricks are prepared in various sizes. The custom in the locality is the governing factor for deciding the size of a brick, such bricks which are not standardised are known as the traditional bricks.

BIS has recommended the bricks of uniform size. Such bricks are known as the modular bricks and the actual size of a modular brick is 190 mm x 90 mm x 90 mm. With mortar thickness, size of such a brick becomes 200 mm x 100 mm x 100 mm and it is known as the nominal size of the modular brick.

It is found that the weight of $1m^3$ of brick earth is about 1800 kg. Hence the average weight of a brick will be about 3.00 to 3.50 kg.

Properties of Bricks

(i) Bricks should be table moulded, well burnt in kilns, copper coloured, free from cracks and with sharp and square edges.

(ii) Bricks should be uniform shape and should be of standard size.

(iii) Bricks should give clear ringing sound when struck each other.

(iv) Bricks when broken should show a bright homogeneous and compact structure free from voids.

(v) Bricks should not absorb water more than 20 percent by weight for first class bricks and 22 percent by weight for second class bricks, when soaked in coldwater for a period of 24 hours.

(vi) Bricks should be sufficiently hard no impression, should be left on brick surface, when it is scratched with finger nail.

(vii) Bricks should be low thermal conductivity and they should be sound proof.

(viii) Bricks should not break when dropped flat on hard ground from a height of about one meter.

(ix) Bricks, when soaked in water for 24hours, should not show deposits of white salts when allowed to dry in shade.

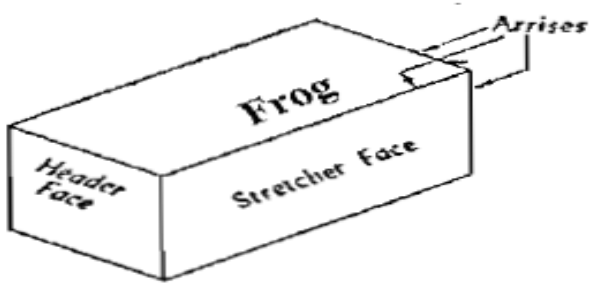
(x) No brick should have crushing strength below 55kg/cm2

Engineering Applications of Bricks

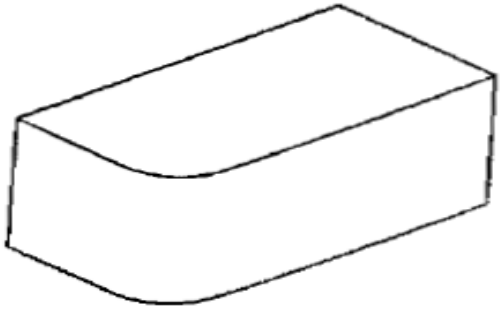
Bricks are made in a variety of shapes to suit the particular work for which they are required. The different kinds of bricks generally turned out in India are given below.

1. Rectangular or Ordinary Bricks

Ordinary bricks are rectangular in section, both longitudinal and transverse and solid throughout. Most ordinary bricks have a hollow mark in one of the larger surfaces called the frog. This is to afford a key to the mortar.



2. Bull-nose Bricks



Bull-nose brick shown in used for rounding off sharp corners. The bricks is sometimes called a cow nose. It is suitable for copings.

3. Squint Bricks

squint quoins.

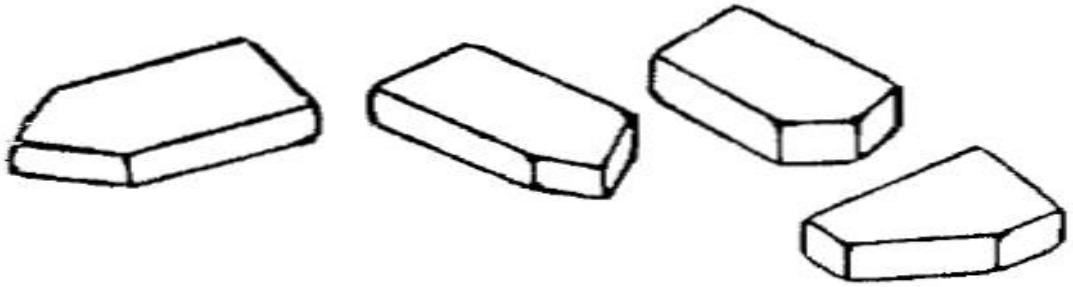


Fig. 2.2.8. Squint Bricks

4. Dog leg or Angle Bricks

This brick is also used as squint quoins particularly for cavity walls.

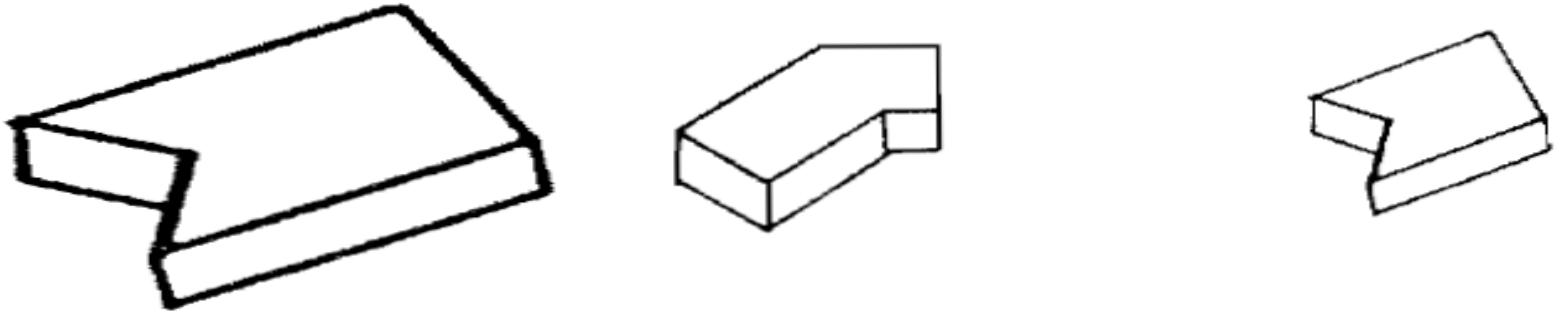


Fig. 2.2.9. Dog leg or Angle Bricks

5. Birds mouth Bricks

This bricks may be used at alternate courses of internal squint quoins.

6. Plinth Bricks

These bricks are used in plinths, in door and window jambs.

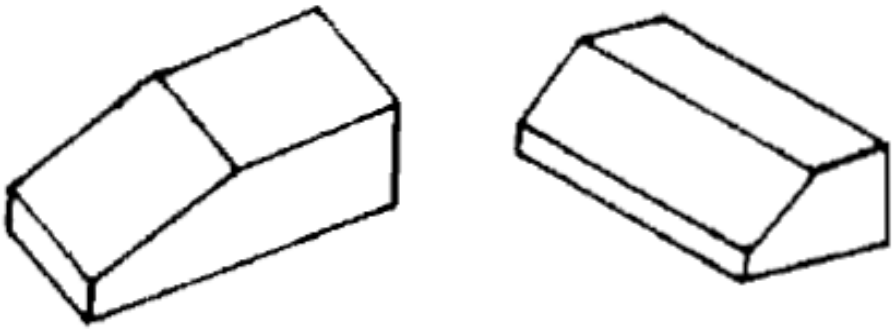


Fig. 2.2.10. Plinth Bricks

7. Coping Bricks

These are made in different forms and are used in copings. A few standard shapes are Bull-nose bricks are used for the same purpose.

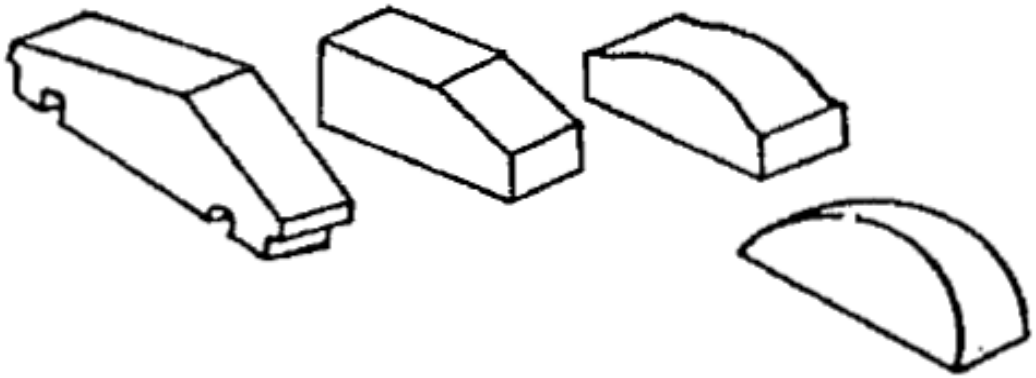


Fig. 2.2.11. Coping Bricks

8. Cornice and String Bricks

These are made in a variety of shapes are used for forming circular or curved angles between walls or between a wall and a floor.

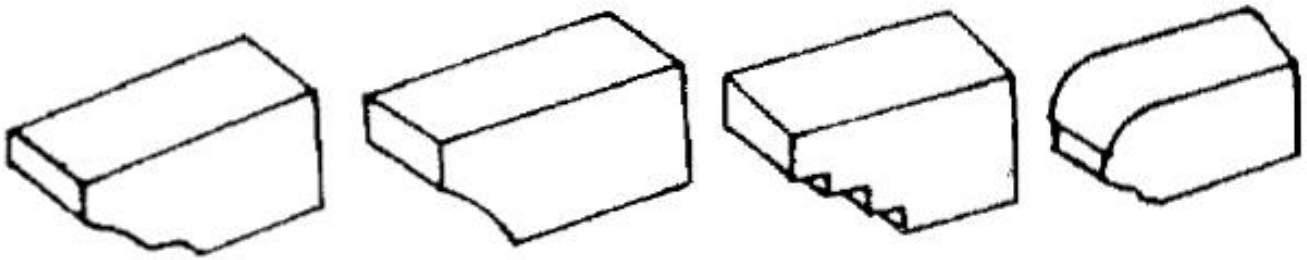


Fig. 2.2.12. Cornice and String Bricks

9. Gutter Bricks

This brick are also called channel brick and is used the construction of gutters.

Fig. 2.2.13. Gutter Bricks

10. Tapering Bricks

This brick is also known as voussoir brick and is used for the construction of important brick arches over door and window openings.

11. Circular Bricks

This brick used for circular work in the construction of bay wind'.- vs, staircase, wells and chimneys.

12. Hollow Bricks

These are made in different patterns for building hollow walls. These are usually made with one or more cavities which reduce their weight about 25 percent and increase insulation against heat, sound and damp.

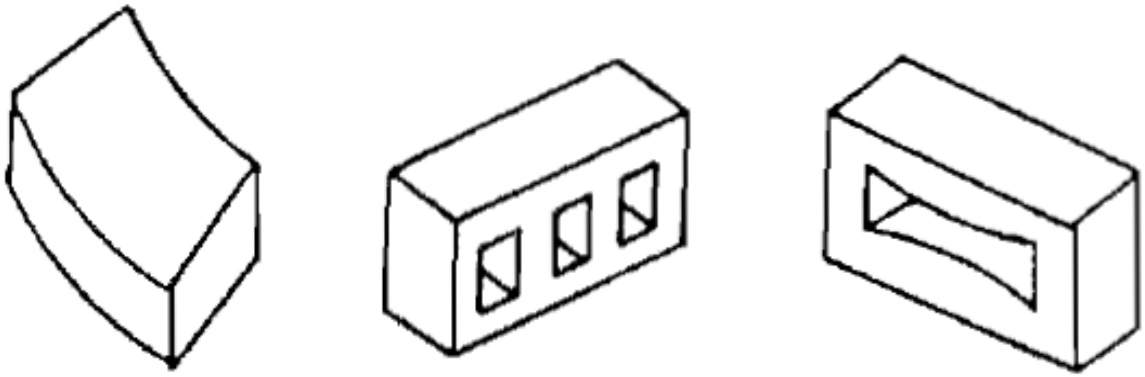


Fig. 2.2.14. Hollow Bricks

13. Keyed or Nicked Bricks

These have usually dovetailed grooves formed on one stretcher and one header face for the purpose of providing a good bond with either plaster or rough cast which may be applied to the brickwork.

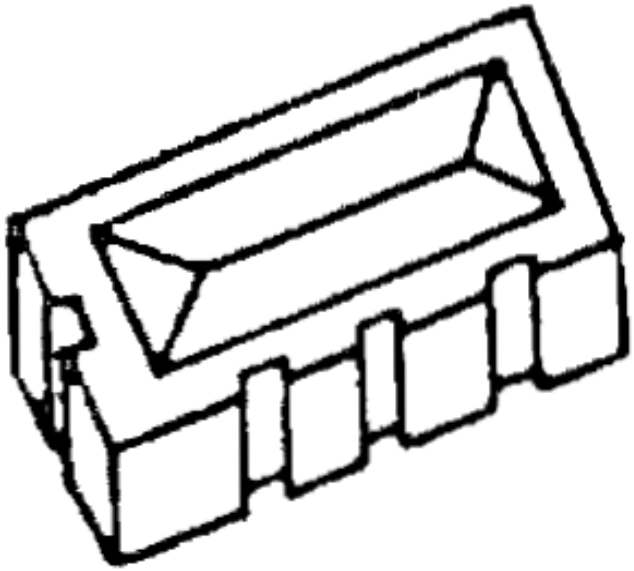
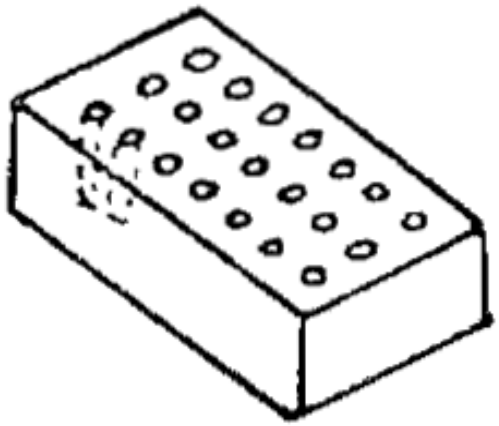


Fig. 2.2.15. Keyed or Nicked Bricks

14. Perforated Bricks

These have small holes (10 mm to 15 mm in diameter) formed throughout their thickness, the object of which is to reduce their weight.



CEMENT

Cement in its broadest term means any substance which acts as a binding agent for materials.

Natural cement (Roman Cement) is obtained by burning and crushing the stones containing clay, carbonates of lime and some amount of carbonate of magnesia. The clay content in such stones is about 20 to 40 percent.

Natural cement resembles very closely eminent hydraulic lime. It is not strong as artificial cement, so it has limited use in practice.

Artificial cement is obtained by burning at very high temperature a mixture of calcareous and argillaceous materials in correct proportion. Calcined product is known as clinker. A small quantity of gypsum is added to clinker and it is then pulverized into very fine powder is known as cement.

Cement was invented by a mason **Joseph Aspdin** of leeds in England in 1824. The common variety of artificial cement is known as normal setting cement or ordinary cement or Portland cement.

Ordinary Portland cement contains two basic ingredients, namely argillaceous and calcareous.

In argillaceous materials, clay predominates and in calcareous materials, calcium carbonate predominates.

Properties of Cement

1) COLOUR

Absolute colour of the cement should be in its cement colour, when cement it is seen. That is light green with ash colour.

2) Physical Properties

When Cement is touched it should be smooth. When cement is rubbed with fingers it should be smooth. If it is rough it denotes mixture of sand, when hand is inserted in the bag coolness should be felt and it should not be warm.

When small quality of cement is put in water it should settle at the bottom and should not float.

3) Presence of lumps

Cement inside the bag should not harden due to moisture. If it is harden the cement should not be used.

4) STRENGTH

A cement cube of size 25 mm x 25 mm x 20 mm is made and it is immersed in water for 7 days cube is kept @ an interval of 250 mm and this cement cube should not brake when 34 kg weight is pressed.

Properties of Portland Cement

1) Initial setting time of cement should not be less than 30 minutes.
2) Final setting time should not be more than 10 hours.
3) After 3 days compressive force should not be less than 16 N/mm^2.
4) After 7 days compressive force should not be more than 22 N/mm^2.
5) After 3 days Tensile force should be 2 N/mm^2.
6) After 7 days Tensile force should be 2.5 N/mm^2.
7) The residue should not be more than 10%. When sieved in I.S. 90 micron Sieve.
8) Should not expand more than 19 mm in L-chatlier test.

Excellent Admixtures are Pozzuolona, Otter, Retarder Air entraining agents, erosion resisting agents, bonding agents, colouring agents.

Engineering Applications of Cement

1. Cement mortar for masonry work, plaster, pointing etc
2. Concreter for laying floors, roofs and constructing lintels, beams, weather sheds, stairs, pillars etc.
3. Construction of important engineering structure such as bridges, culverts, dams, tunnels storage reservoirs, light houses, deckles etc.
4. Construction of water tanks, wells, tennis courts, septic tanks, lampposts, roads, telephone cabins etc.
5. Making joints for drains, pipes etc.
6. Manufacture of pre cast pipes, piles, garden seats, artificially designed urns, flowerpots, etc dustbins, fencing posts etc.
7. Preparation of foundations, watertight floors, footpaths etc.

CONCRETE

CONCRETE

Cement concrete is a mixture of cement, sand, pebbles or crushed rock and water. When placed in the skeleton of forms and allowed to cure, becomes hard like a stone.

Cement concrete is important building material because of the following reasons.

1. It can be moulded into any size and shape of durable structural member.
2. It is possible to control the properties of cement concrete.
3. It is possible to mechanise completely its preparation and placing processes.
4. It possesses adequate plasticity for mechanical working.

Properties of Concrete

1. It has high compressive strength
2. It is free from corrosion
3. It hardens with age and continues for a long time after concrete has attained sufficient strength
4. It is proved to be economical than steel
5. It binds rapidly with steel and it is weak in tension, steel reinforcement is placed in cement concrete at suitable places to take up tensile concrete or simply R.C.C.
6. It forms a hard surface, capable of resisting abrasion stresses. This is called reinforced cement.
7. It has tendency to be porous to avoid this proper grading & consolidation of the aggregates, minimum water-cement ratio should be adopted.

Engineering Applications of Concrete

1:2:2 - For heavy loaded R.C.C columns and R.C.C arches of long spans

1:2:2 - For small pre cast members of concrete like fencing poles, telegraph poles etc. watertight construction.

1:2:3 - For water tanks, bridges, sewers etc.

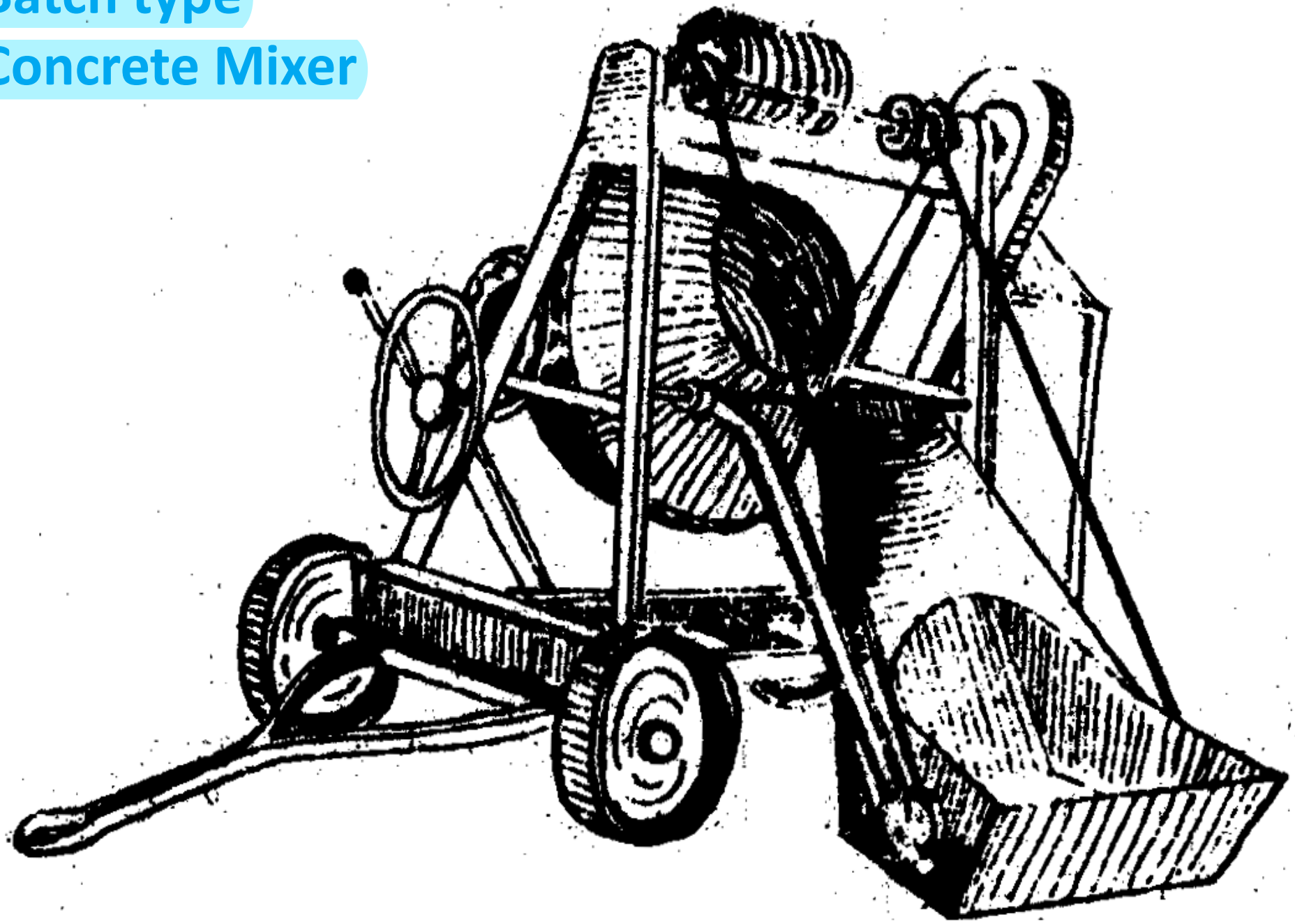
1:2½:3½ - For foot path, concrete roads

1:2:4 - For general work of RCC such as stairs, beams, columns, slabs, etc

1:4:8

1:5:10 — For mass concrete for heavy walls, foundation footings etc.

Batch type Concrete Mixer



RCC - Reinforced Cement Concrete

Concrete is strong in compression, but relatively weak in tension. The reverse is true for slender steel bars. When concrete and steel are used together, one makes up for the deficiency of the other. The most common type of steel reinforcement employed in concrete building construction consists of round bars, usually of the deformed type, with lugs or projections on their surfaces.

The purpose of the surface deformations is to develop a greater bond between the concrete and the steel. The bars are made from billet steel, rail steel, or axle steel, conforming to rigid specifications. Welded-wire fabric is another type of reinforcement that consists of a series of parallel-longitudinal wires welded at regular intervals to transverse wires. It is available in sheets and rolls and is widely used as reinforcement in floors and walls.

PSC - Pre-Stressed Concrete

Prestressed concrete is a form of concrete used in construction. It is substantially "prestressed" (compressed) during production, in a manner that strengthens it against tensile forces which will exist when in service.

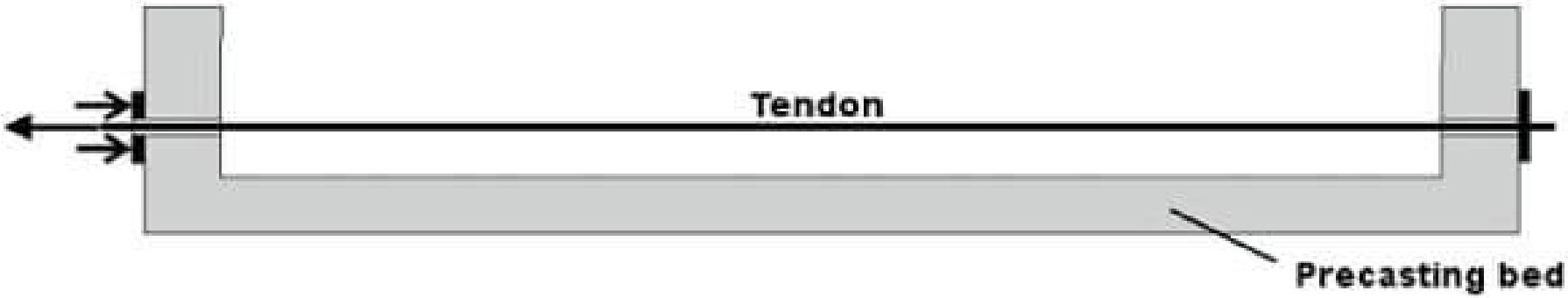
Prestressed concrete is a system devised to provide sufficient precompression in the concrete beam by tensioned steel wires, cables, or rods that under working conditions the concrete has no tensile stresses or the tensile stresses are so low that no visible cracking occurs.

In a prestressed concrete member, the internal stresses are introduced in a planned manner so that the stresses resulting from the imposed loads are counteracted to the desired degree.

Prestressed concrete is used in a wide range of building and civil structures where its improved performance can allow for longer spans, reduced structural thicknesses, and material savings compared with simple reinforced concrete.

Typical applications include high-rise buildings, residential slabs, foundation systems, bridge and dam structures, silos and tanks, industrial pavements and nuclear containment structures.

Tension the prestressing tendons against the end abutments



Cast the beam concrete

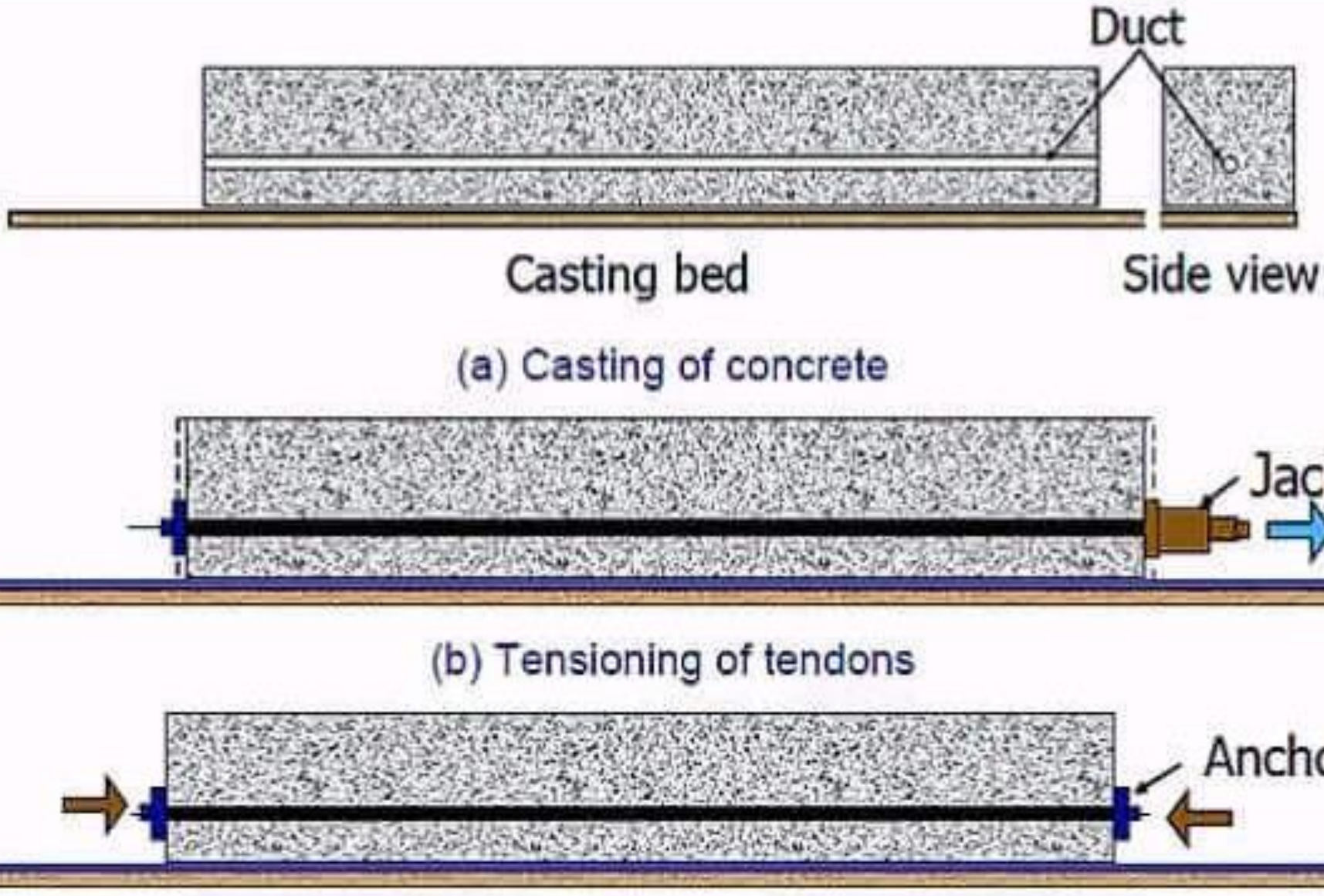
Release the end anchorages, prestressing the beam


8 7 6 5
8 7 6 5
8 7 6 5
8 7 6 5

Pre-tensioning is a common prefabrication technique, where the resulting concrete element is manufactured off-site from the final structure location and transported to site once cured.

It requires strong, stable end-anchorage points between which the tendons are stretched. These anchorages form the ends of a "casting bed" which may be many times the length of the concrete element being fabricated.

This allows multiple elements to be constructed end-to-end in the one pre-tensioning operation, allowing significant productivity benefits and economies of scale to be realized



Stages of post-tensioning


BMRCL
NAVAYUGA
namma metro

Post-tensioned concrete is a variant of prestressed concrete where the tendons are tensioned *after* the surrounding concrete structure has been cast.

The tendons are not placed in direct contact with the concrete, but are encapsulated within a protective sleeve or duct which is either cast into the concrete structure or placed adjacent to it. At each end of a tendon is an anchorage assembly firmly fixed to the surrounding concrete.

Once the concrete has been cast and set, the tendons are tensioned ("stressed") by pulling the tendon ends through the anchorages while pressing against the concrete. The large forces required to tension the tendons result in a significant permanent compression being applied to the concrete once the tendon is "locked-off" at the anchorage

Advantages of Prestressed Concrete

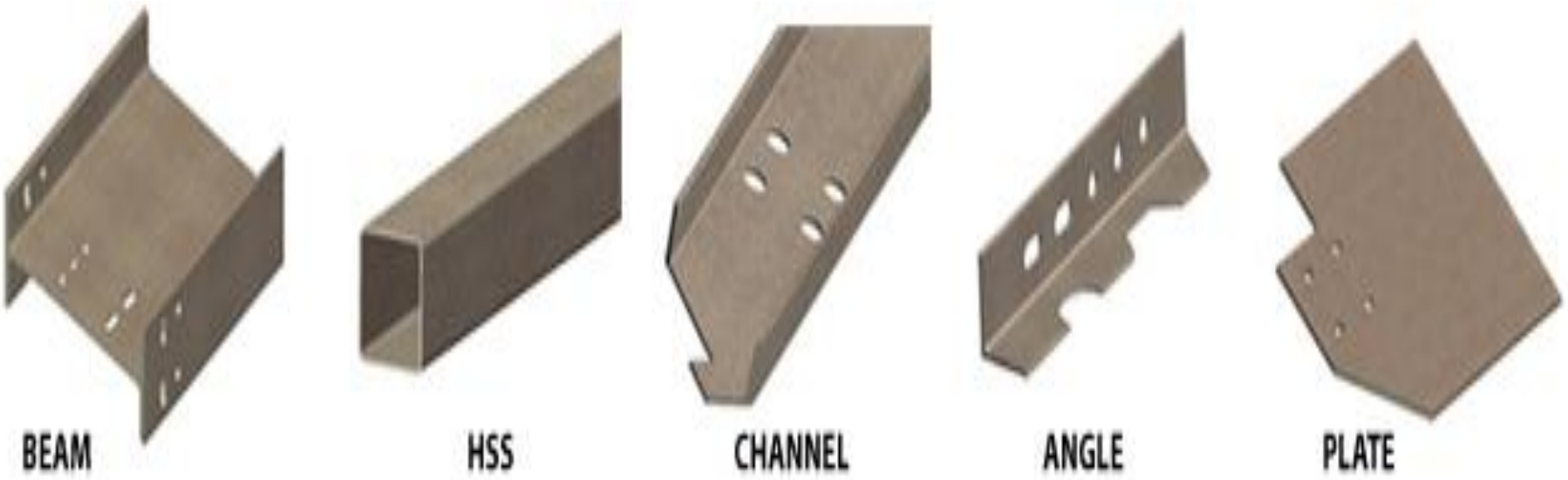
With the help of pre-stressed concrete, sleek and slender concrete structures can be constructed. due to these dead load of the structure gets reduced.

- Consumption of materials like concrete, steel is reduced.
- Longer beams spans and girders can be constructed which gives the untroubled floor space and parking facilities.
- It has long-term durability.
- Possibility of steel corrosion and subsequent concrete deterioration are declined because of concrete is crack free.
- Pre-stressed concrete bridges are not easily damaged by fire they have excellent fire resistance and low maintenance costs in comparison to reinforced concrete.
- Pre-stressed concrete offers greater load resistance and shock resistance.
- The compressive strength of concrete and tensile strength of steel is used to their fullest.

Disadvantages of Prestressed Concrete

- Pre-stressed concrete requires high-quality dense concrete of high-strength.
- High strength concrete in production, placement and compaction is required.
- It requires high tensile steel which is 2.5 to 3.5times costlier than mild steel.
- Prestressing process requires complicated tensioning equipment and anchoring devices which are very costly.
- Pre-stressed concrete construction requires very good quality control and supervisions.
- Pre-stressed concrete needs skilled labourers.
- Prestressing is uneconomical for shorts spans and light loads.

Structural steel



Structural steel is a category of steel used for making construction materials in a variety of shapes.

Many structural steel shapes take the form of an elongated beam having a profile of a specific cross section.

Structural steel shapes, sizes, chemical composition, mechanical properties such as strengths, storage practices, etc., are regulated by standards in most industrialized countries.

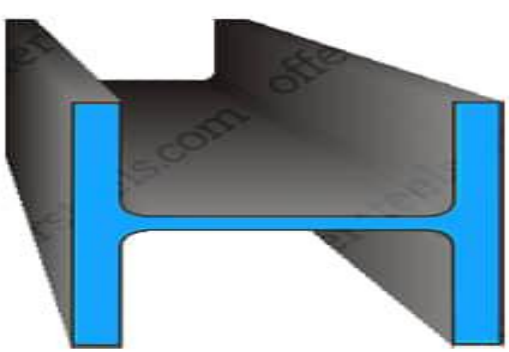
Common structural shapes

I-beam (**I**-shaped cross-section – in Britain these include Universal Beams (UB) and Universal Columns (UC); in Europe it includes the IPE, HE, HL, HD and other sections; in the US it includes Wide Flange (WF or W-Shape) and **H** sections)

Z-Shape (half a flange in opposite directions)

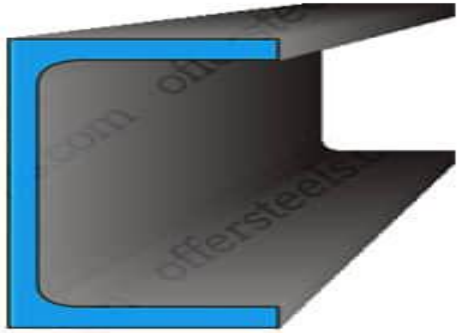
HSS-Shape (Hollow structural section also known as SHS (structural hollow section) and including square, rectangular, circular (pipe) and elliptical cross sections)

Angle (**L**-shaped cross-section)



H

I



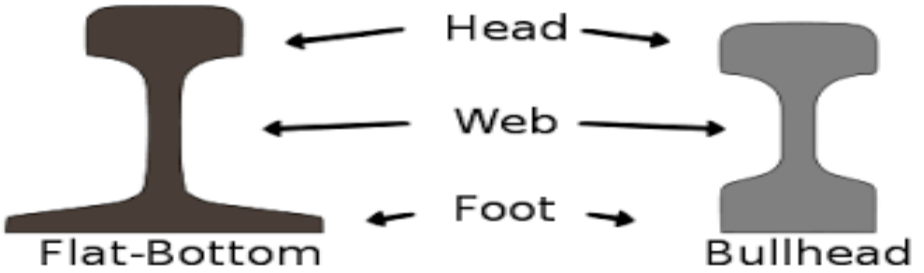
C / U

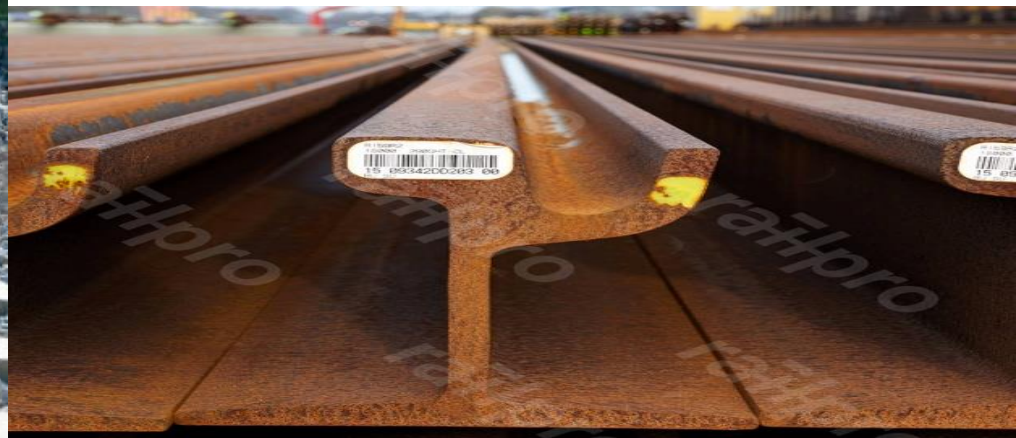
Structural channel, or **C**-beam, or **C** cross-section

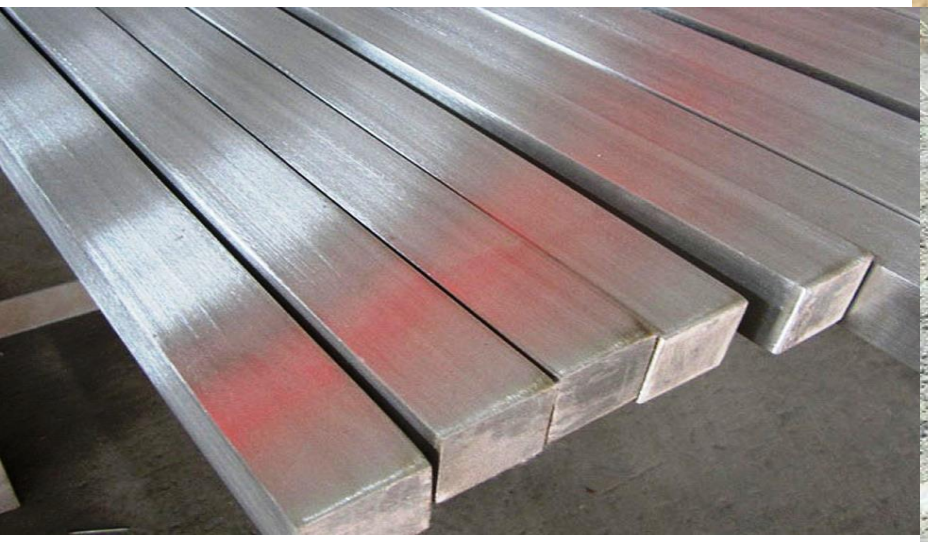
Tee (**T**-shaped cross-section)

Rail profile (asymmetrical **I**-beam)

- Railway rail
- Vignoles rail
- Flanged **T** rail
- Grooved rail



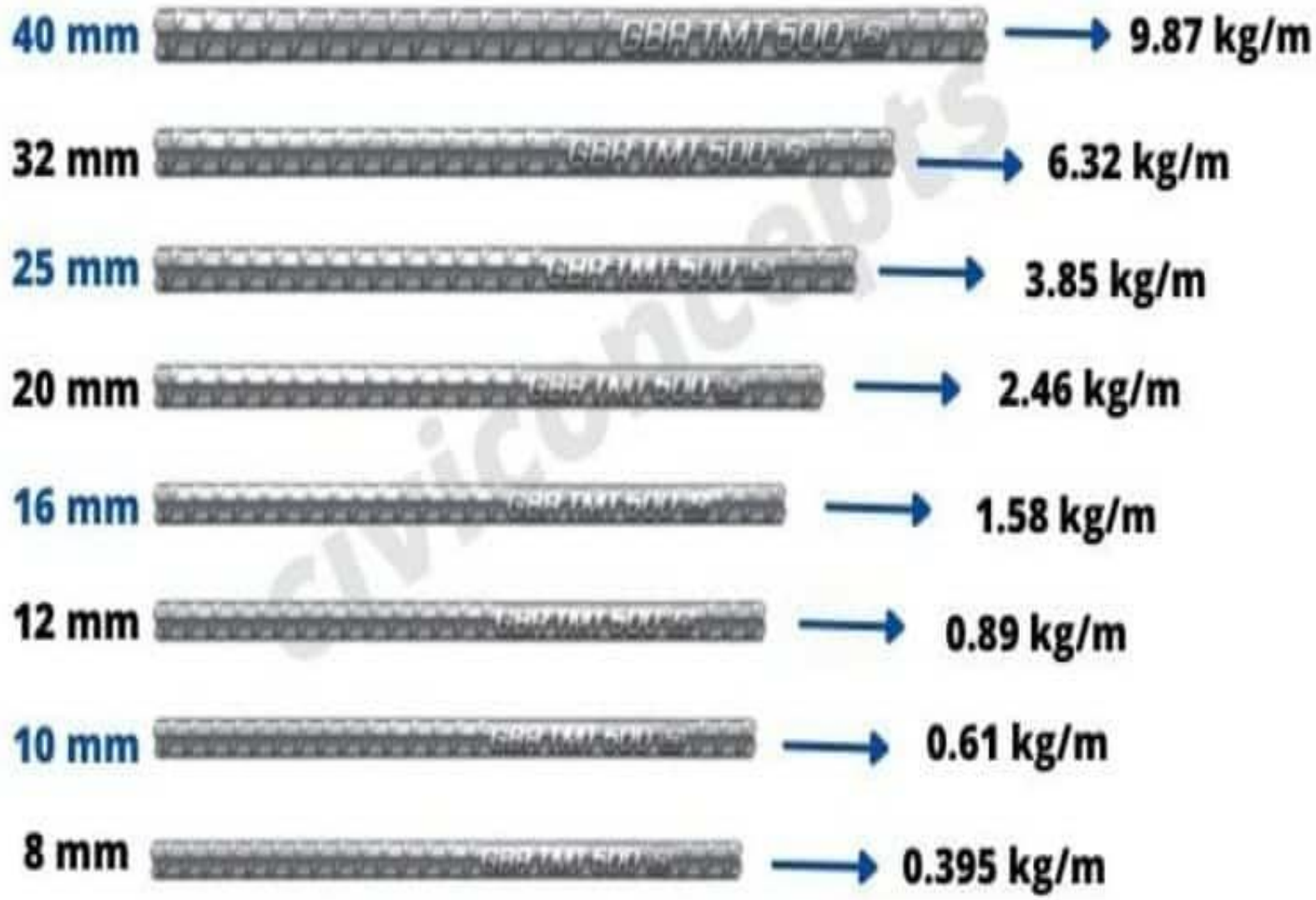




Bar, a long piece with a rectangular cross section, but not so wide so as to be called a sheet.

Rod, a round or square section long compared to its width; see also rebar and dowel.

Unit Weight of Steel Bars



In India Steel bar are manufactured for standard length is 12 m.

Total weight of Steel for Each Dia = Nos. of Steel x Unit Wt. x Length of bars

20 mm 

20 mm = 30 nos.

= 30 x 2.46 x 12 = 885.6 kg

16 mm 

16 mm = 60 nos.

= 60 x 1.58 x 12 = 1137.6 kg

12 mm 

12 mm = 50 nos.

= 50 x 0.89 x 12 = 534 kg

10 mm 

10 mm = 120 nos.

= 120 x 0.620 x 12 = 892.8 kg

8 mm 

8 mm = 80 nos.

= 80 x 0.395 x 12 = 379.2 kg

Plate, metal sheets thicker than 6 mm or 1⁄4 in.

Open web steel joist

Standard structural steels

- **Carbon steels**

Steel with carbon content from about 0.05 up to 2.1 percent by weight.

It is used to construct buildings, bridges, and other infrastructure projects.

- **High strength low alloy steels**

They have a carbon content between 0.05 and 0.25% to retain formability and weldability.

They are used in cars, trucks, cranes, bridges, roller coasters and other structures that are designed to handle large amounts of stress or need a good strength-to-weight ratio.

- **Corrosion resistant high strength low alloy steels**

The most common of the corrosion resistant alloys, **stainless steel**, by definition contains a minimum of 10.5% chromium.

Standard structural steels

- **Quenched and tempered alloy steels**

The carbon content of quenched and tempered steels ranges between 0.20 to 0.60%.

- **Forged steel**

Forged steel is an alloyed iron-carbon mixture that has undergone an intense heating process known as forging. This process creates a very strong and durable material with a higher tensile strength than regular carbon steel.

Construction chemicals

Construction chemicals are chemical formulations used with masonry materials, cement, concrete or other construction materials at the time of construction to hold the construction materials together.

The global construction chemical market is categorized as:

1. Protective coating
2. Adhesive and sealant
3. Concrete mixtures
4. Asphalt Modifiers

1. Concrete Hardeners

These are chemicals added in floor concrete in order to render it denser and more durable. They also usually enhance chemical resistance, impact & abrasion resistance, waterproofing capability etc. besides reducing dusting. All these are required attributes especially for industrial, commercial or factory floors. Ultimately good quality floor hardeners reduce repairs and maintenance of concrete floors drastically besides making them long lasting thus adding to cost effectiveness as well. Floor hardeners can be liquid or solid, metallic or non metallic. Metallic floor hardeners (solid) are well graded ferrous aggregates. Liquid floor hardeners are water, silicate etc. based solutions. Pigmented floor hardeners also improve the appearance of floor surfaces. Floor hardeners are usually applied as per manufacturer's specifications This construction chemical Improves the abrasion resistance of dusty or poorly cured concrete by up to 3 times. Has good resistance to alkali solution and petroleum solvents but poor resistance to strong acids.

2. Protective and Decorative coating

A protective coating is a layer of material applied to the surface of another material with the intent of inhibiting or preventing corrosion. A protective coating may be metallic or non-metallic. Protective coatings are applied using a variety of methods, and can be used for many other purposes besides corrosion prevention. Commonly used materials in non-metallic protective coatings include polymers, epoxies and polyurethanes. Materials used for metallic protective coatings include zinc, aluminum and chromium. Special materials are used in the finishing coats of plastering or over the plastered surfaces to meet one or more of specific requirements such as decorative appearance, high durability, fire – proofing, heat insulation, sound insulation, early completion, high strength etc.

3. Concrete Curing

Concrete curing compound consists essentially of waxes, natural and synthetic resins, and solvents of high volatility at atmospheric temperatures. The compound forms a moisture retentive film shortly after being applied on a fresh concrete surface. White or gray pigments are often incorporated to provide heat reflectance, and to make the compound visible on the structure for inspection purposes. Curing compound should not be used on surfaces that are to receive additional concrete, paint, or tile which require a positive bond, unless it has been demonstrated that the membrane can be satisfactorily removed before the subsequent application is made, or that the membrane can serve satisfactorily as a base for the later application.

4. Epoxy Coating

These can come as water or oil based solutions or as solvent-free. They can be single or two-component. Single-component epoxy paints are usually oil based. Two-component epoxy coatings are mixed in situ in proportions as prescribed by their manufacturers and they are quite suitable for factory, industrial or commercial building applications by dint of their excellent chemical & thermal resistant characteristics, hardness, durability, waterproofing characteristics etc. They are solvent-free. Epoxy coatings are also used in flooring for decorative purposes.

5. Mould Releasing Agents

Mould release agents come in handy when you have materials that are shaped and constructed in moulds. Without the releasing agent, your mould may become damaged or even break when it is time to remove it. Mould release agents come in a variety of textures with the most commonly used one being an oil type base. If you have never used a releasing agent before, it is similar to placing oil or butter in the bottom of a dish to remove your final baking product. Below, you will find the three most commonly used types and their purpose in the manufacturing industry.

6. Polymer Bonding Agent

Polymer Bonding Agent is an aqueous emulsion of a polymer and chemical admixtures. It is designed for use as a bonding agent with concrete and cement-based products in interior or exterior applications. Polymer Bonding Agent is also designed for use as a polymer modifier in mortars and concretes to develop increased tensile, flexural and bond strengths. The use of Polymer Bonding Agent in concrete and shotcrete also gives significant improvements in resistance to penetration by chlorides and de-icing salts.

7. Ready Mix Plaster

Ready mix plaster is a factory mixed/premixed sand-cement based plaster. All the activities that are generally undertaken on-site are performed in a quality-controlled environment at the plant to ensure no-batch variation and optimum sand gradation, which is of utmost importance for any plaster. Other additives such as fly ash and polymers are also added to it, to improve its performance and various other properties. These are generally used for building houses or making solid structures of any sort. Apart from these, they can also be used for various other purposes that require you to put two or more things together that will hold strong for long. You can also use ready mix plaster to make models.

8. Polymer Modified Mortar

Polymer-modified mortar is made by replacing a portion of the traditional binders with polymers. Polymers are added to mortar to increase characteristics that may include adhesion, toughness, flexural or tensile strength, and resistance to chemicals. Polymers act to improve the workability and adhesion of non-hardened mortar and often require less added water than does traditional mortar, which results in fewer pores and stronger cements, subsequently reducing water ingress and permeability to salts. Polymer-modified mortar is often commercially available with all ingredients already included in the mixture.

9. Waterproofing Chemicals

These chemicals can be quite useful when a structure's waterproofing capability is to be given a boost which is especially required for structures constantly dealing with liquids. There are many varieties. Some of them are crystalline waterproofing chemicals, liquid acrylic elastomeric waterproofing compounds, polymer modified waterproofing compounds, cementitious waterproofing compounds etc. Many of these compounds form membranes on the concrete surfaces to protect them from ingress of water.

MASONRY

Masonry

- Masonry may be defined as the construction of building units bonded together with mortar.

- The building units may be stones, bricks, or precast blocks of concrete.
- Masonry is normally used for the construction of foundations, walls and other similar structural components of the buildings.
- Masonry has got the highest importance in building industry.

- It performs variety of functions, such as:

(i) supporting loads (ii) subdividing space

(iii) providing thermal and acoustic insulation.

(iv) affording fire and weather protection, Etc.,.

Definition of terms used in Masonry

1. **Course**: A course is a horizontal layer of masonry units. Thus, in stone masonry , the thickness of course will be equal to the height of the stones plus thickness of one mortar joint.

2.Header: A header is a full stone unit or brick which is laid that its length is perpendicular to the face of the wall. Thus , the longest length of a header lies at right angles to the face of the work.

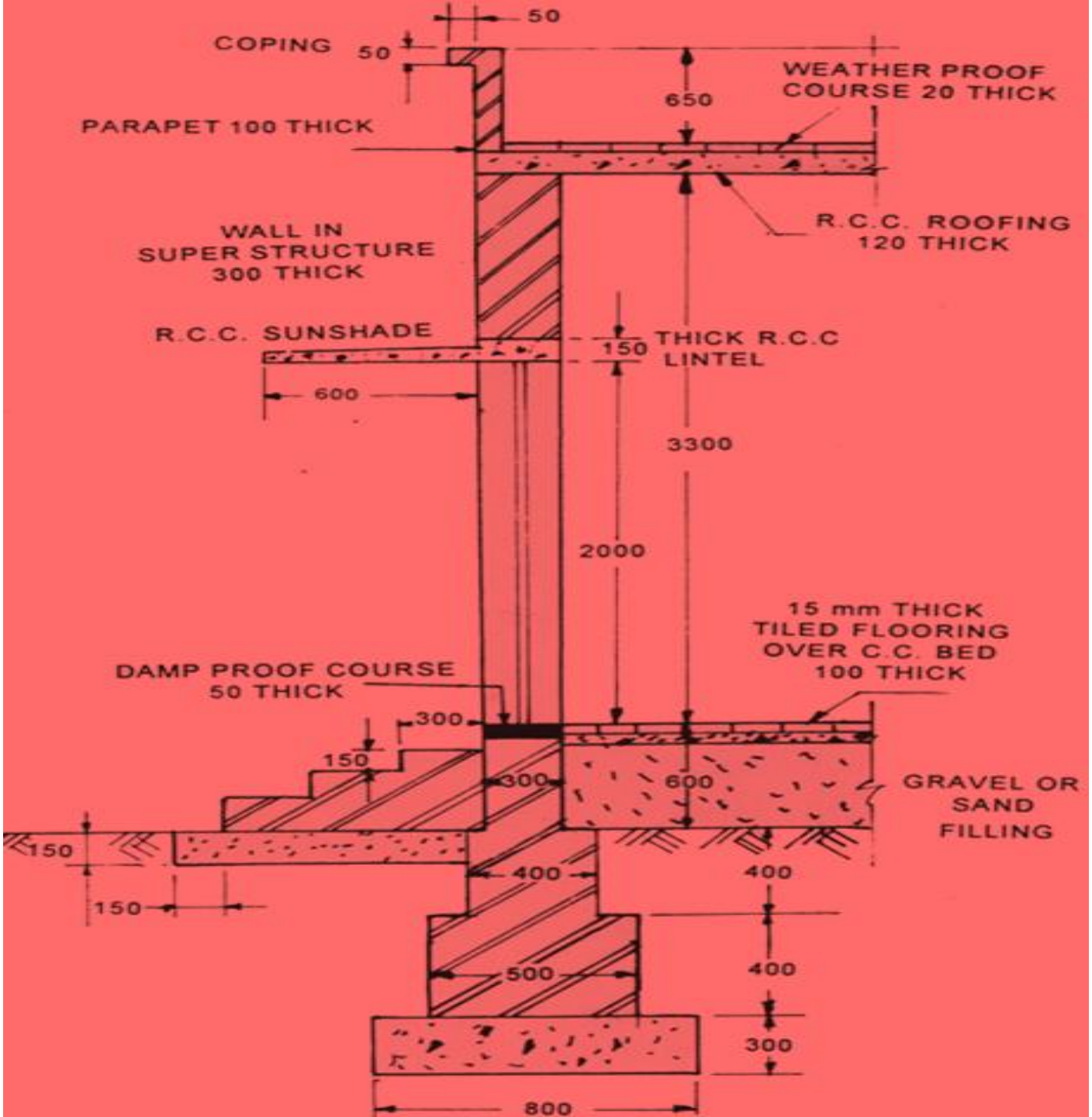
3. Stretcher: A stretcher is a full stone unit or brick which is so laid that its length is along or parallel to the face of the wall. Thus, the longest length of stretcher lies parallel to the face of the work.

4.Natural Bed: Stones are obtained from rocks which have distinct planes of divisions along which the stones can easily be split. This plane is known as natural bed.

5. Through stone: A through stone is a stone header. Through stones are placed across the wall at regular interval

6. Sill: The bottom surface of a door or window opening is known as Sill.

7. Lintel: It is a horizontal member of stone, brick , wood, steel or reinforced concrete, used to support the masonry and the super-imposed load above an opening.


50
COPING
50
650
WEATHER PROOF
COURSE 20 THICK
PARAPET 100 THICK
R.C.C. ROOFING
120 THICK
WALL IN
SUPER STRUCTURE
300 THICK
R.C.C. SUNSHADE
150
THICK R.C.C
LINTEL
600
3300
2000
15 mm THICK
TILED FLOORING
OVER C.C. BED
100 THICK
DAMP PROOF COURSE
50 THICK
300
150
300
600
GRAVEL OR
SAND
FILLING
150
400
400
150
500
400
300
800

8.Plinth: Plinth is the horizontal projecting courses of stone or brick, provided at the base of the wall above the ground level.

9.Plinth Course: It is the uppermost course of the plinth masonry.

10.Column : It is a vertical load bearing member of masonry, which is constructed in an isolation from the wall and whose width does not exceed four times its thickness.

11.Pier: Pier is an isolated vertical mass of stone or brick masonry to support beams, lintels arch etc.

Masonry

Masonry may be of the following types:

1. **Stone Masonry**
2. **Brick Masonry**
3. **Cement Concrete Blocks Masonry**
4. **Reinforced Brick Masonry**
5. **Composite Masonry**


STAIRCASE

CONTENTS

- Introduction
- Technical Terms
- Requirements of good Staircase
- Dimensions of step
- Types of steps
- Classification of Staircase

INTRODUCTION

- Stairs is a set of steps which give access from floor to floor.
- The room or enclosure of the building, in which stair is located is known as staircase.
- Staircase provide access & communication between floors in multi-storey buildings and are a path by which fire can spread from one floor to another.
- Therefore it must be enclosed by fire resisting walls, floors, ceilings and doors.
- It must be designed to carry certain loads, which are similar to those used for design of the floors.
- Stairs may be constructed of Timber, Bricks, Stone, Steel or Reinforced Cement Concrete.

TECHNICAL TERMS

- **STEP:-** It is a portion of stair which permits ascent or descent. A stair is composed of a set of steps.
- **TREAD:-** It is a upper horizontal portion of a step upon which foot is placed while ascending or descending.
- **RISER:-** It is a vertical portion of a step providing support to the tread.
- **LANDING:-** It is level platform at the top or bottom of a flight between the floors.
- **FLIGHT:-** This is an unbroken series of steps between landing.

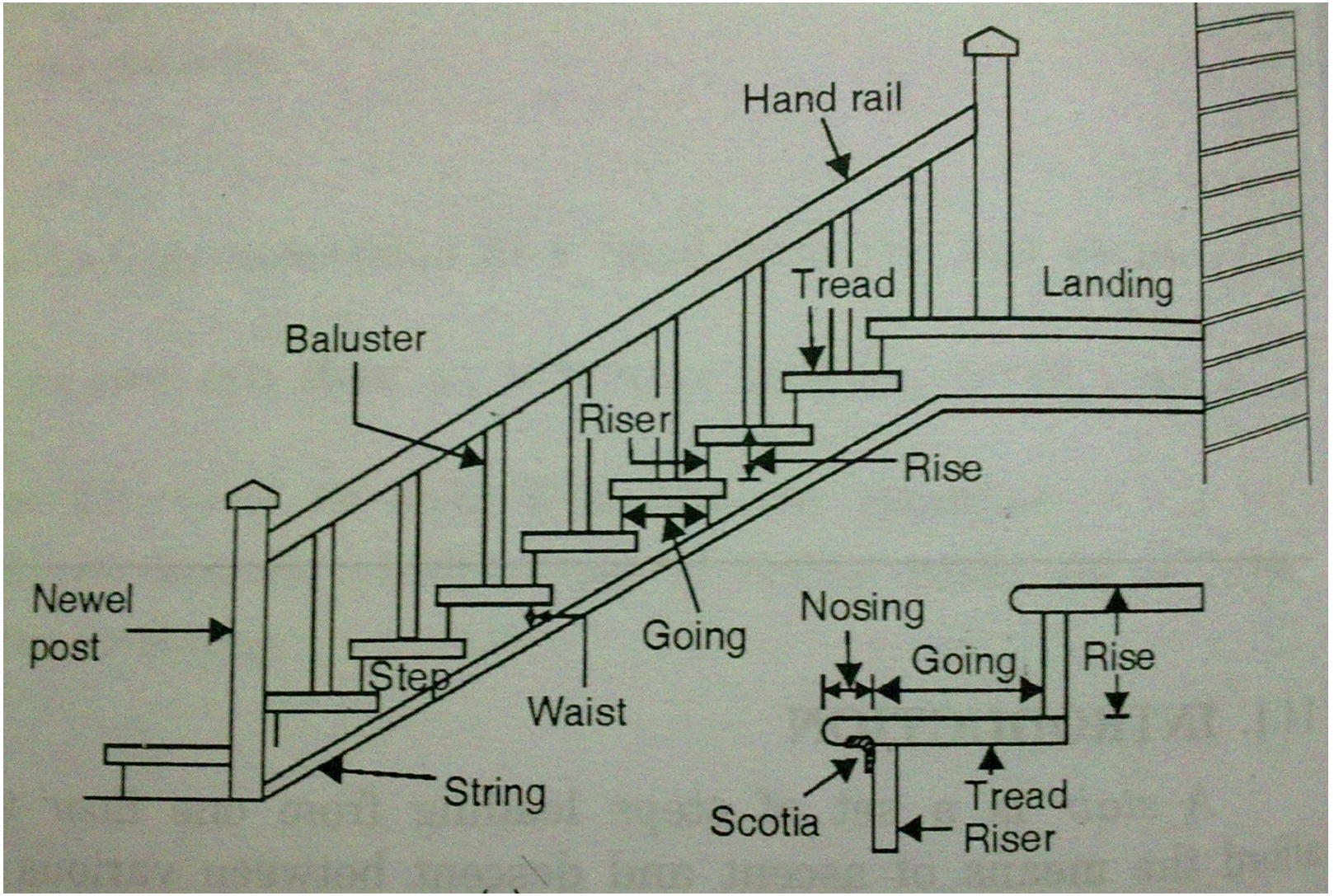
TECHNICAL TERMS

- **RISE:-** It is a vertical distance between two successive tread faces.
- **GOING:-** It is a horizontal distance between two successive riser faces.
- **NOSING:-** It is the projecting part of the tread beyond the face of riser.
- **SCOTIA:-** It is a moulding provided under the nosing to provide strength to nosing.
- **SOFFIT:-** it is the underside of a stair.
- **PITCH OR SLOPE:-** It is the angle which the line of nosing of the stair makes with the horizontal.

TECHNICAL TERMS

- **STRINGS OR STRINGERS:-** These are the slopping members which support the steps in a stair.
- **NEWEL POST:-** Newel post is a vertical member which is placed at the ends of flight to connects the ends of strings and hand rail.
- **BALUSTER:-** It is vertical member of wood or metal, supporting the hand rail.
- **HEAD ROOM:-** It is the clear vertical distance between the tread and overload structure.

TECHNICAL TERMS



REQUIREMENTS OF GOOD STAIRCASE

LOCATION

(a) They should be located near the main entrance to the building.

(b) There should be easy access from all the rooms without disturbing the privacy of the rooms.

(c) There should be spacious approach.

(d) Good light and ventilation should be available.

REQUIREMENTS OF GOOD STAIRCASE

WIDTH OF STAIR

(a) It should be wide enough to carry the user without much crowd on inconvenience.

(b) In Residential building, a 90 cm wide stair is sufficient while in public 1.5 to 1.8 m width may required.

LENGTH OF FLIGHT

(a) The number of steps should not be more than 12 & less than 3 from comfort point of view.

REQUIREMENTS OF GOOD STAIRCASE

PITCH OF STAIR

(a) Pitch should be limited to 30^0 to 45^0.

HEAD ROOM

(a) Height of head room should not be less than 2.1 to 2.3 m.

BALUSTRADE

(a) Stair should always provided with balustrade.

REQUIREMENTS OF GOOD STAIRCASE

STEP DIMENSION

(a) The rise and going should be of such dimensions as to provide comfort to users.

(b) The going should not be less than 25 cm, though 30 cm going is quite comfortable.

(c) The rise should be between 10 to 15 cm.

(d) The width of landing should not be less than width of stair.

MATERIAL OF CONSTRUCTION

(a) The material should have fire resistance and sufficient strong.

THUMB RULES FOR DIMENSIONS OF STEP

(a) (2 X Rise in cm) + (Going in cm) = 60

(b) (Rise in cm) + (Going in cm) = 40 to 45

(c) (Rise in cm) X (Going in cm) = 400 to 450

TYPES OF STEPS

(a) Flier
(b) Bull Nose
(c) Round Ended
(d) Splayed
(e) Commode
(f) Dancing
(g) Winders

CLASSIFICATION OF STAIRCASE

- Straight Staircase
- Turning Staircase

(a) Quarter Turn

(b) Half Turn (Dog-Legged & Open well Staircase)

(c) Three-Quarter Turn Staircase

(d) Bifurcated Staircase

- Continuous Staircase

(a) Circular Staircase

(b) Spiral Staircase

(c) Helical Staircase

STRAIGHT STAIRCASE

- If the space available for stair case is narrow and long, straight stairs may be provided.
- Such stairs are commonly used to give access to porch or as emergency exits to cinema halls.
- In this type all steps are in one direction.
- They may be provided in single flight or in two flights with landing between the two flights

STRAIGHT STAIRCASE

QUARTER TURN STAIRCASE

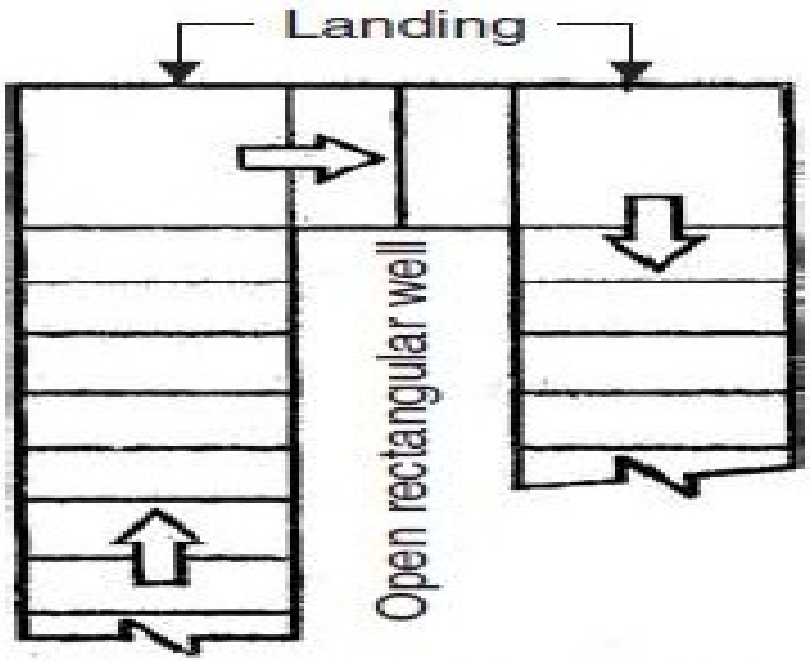
DOG-LEGGED STAIRCASE

- It consists of two straight flights with 180° turn between the two.
- They are very commonly used to give access from floor to floor.
- Photograph shows the arrangement of steps in such stairs.

DOG-LEGGED STAIRCASE

OPEN WELL OR NEWEL STAIRCASE

- It differs from dog legged stairs such that in this case there is 0.15 m to 1.0 m gap between the two adjacent flights.

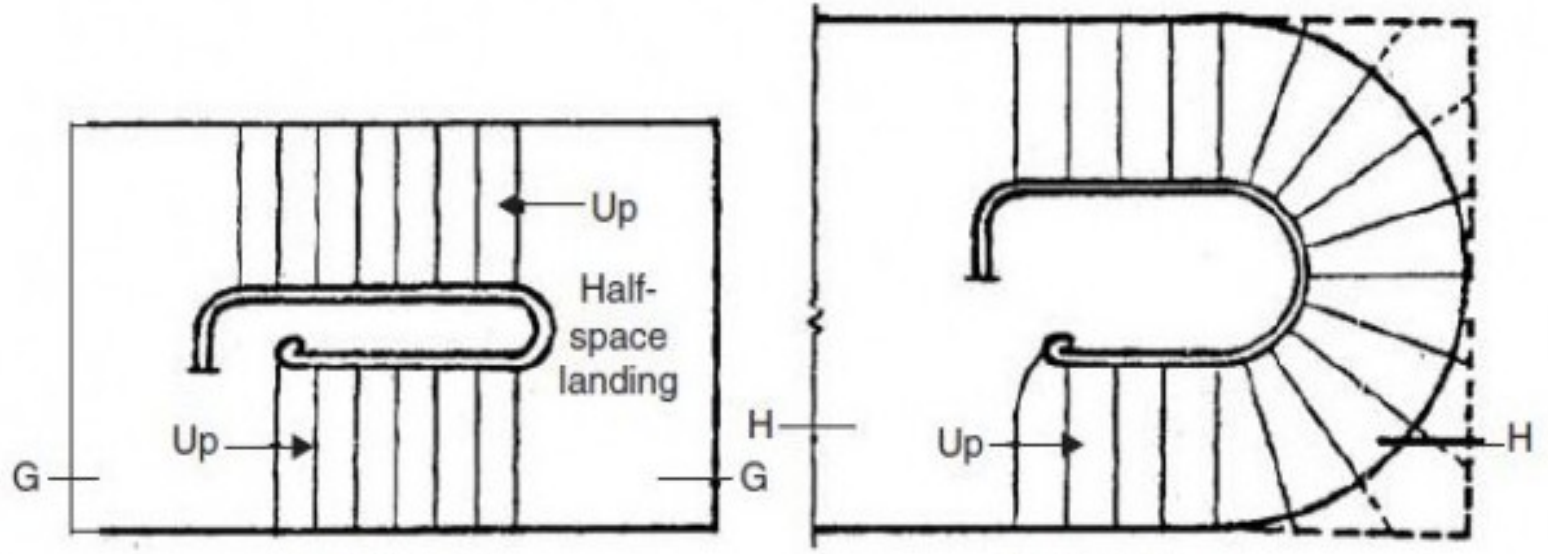


Open well (newel) stair

OPEN WELL OR NEWEL STAIRCASE

GEOMETRICAL STAIRCASE

- This type of stair is similar to the open newel stair except that well formed between the two adjacent flights is curved.
- The hand rail provided is continuous.



Geometric stairs

GEOMETRICAL STAIRCASE

BIFURCATED STAIRCASE

- Apart from dog legged and open newel type turns, stairs may turn in various forms.
- They depend upon the available space for stairs. Quarter turned, half turned with few steps in between and bifurcated stairs are some of such turned stairs.
- Figure shows a bifurcated stair.

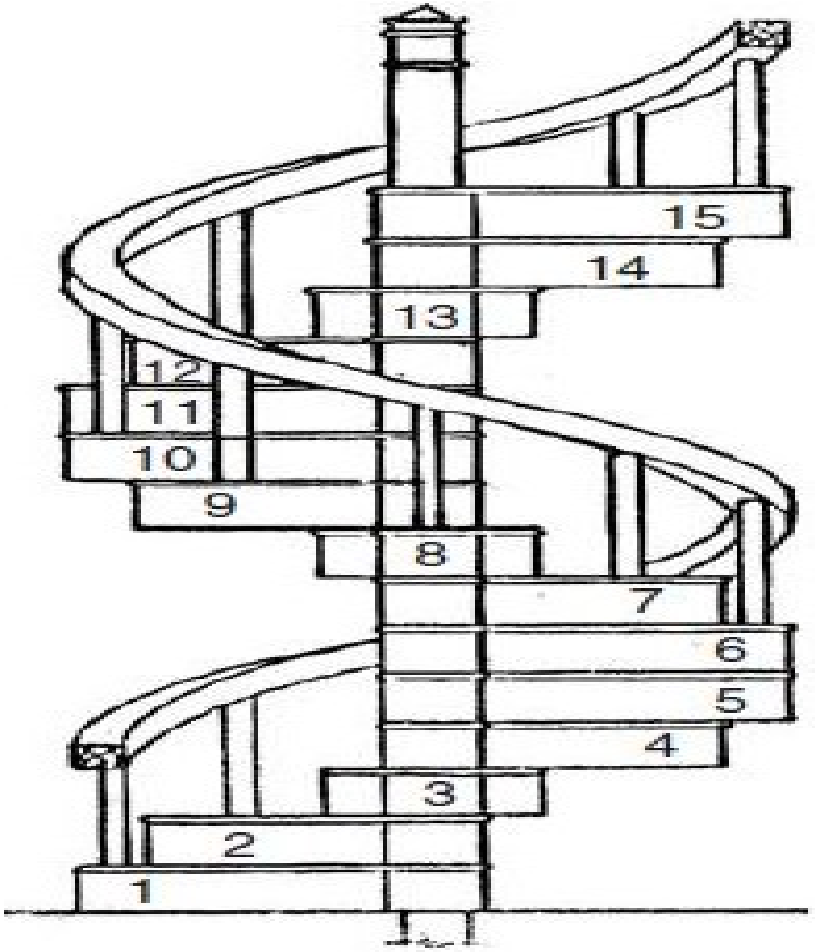
BIFURCATED STAIRCASE

BIFURCATED STAIRCASE

SPIRAL STAIRCASE

- These stairs are commonly used as emergency exits.
- It consists of a central post supporting a series of steps arranged in the form of a spiral.
- At the end of steps continuous hand rail is provided.
- Such stairs are provided where space available for stairs is very much limited.
- Figure shows a typical spiral stair. Cast iron, steel or R.C.C. is used for building these stairs.

SPIRAL STAIRCASE



Spiral stairs

SPIRAL STAIRCASE

MATERIALS USED IN CONSTRUCTION OF STAIRCASE

- Timber
- Metal
- R.C.C.
- Stone
- Glass

TIMBER STAIRCASE

METAL STAIRCASE

R.C.C. STAIRCASE

STONE STAIRCASE

GLASS STAIRCASE

Thank You !!!

LINTEL

What is Lintel?

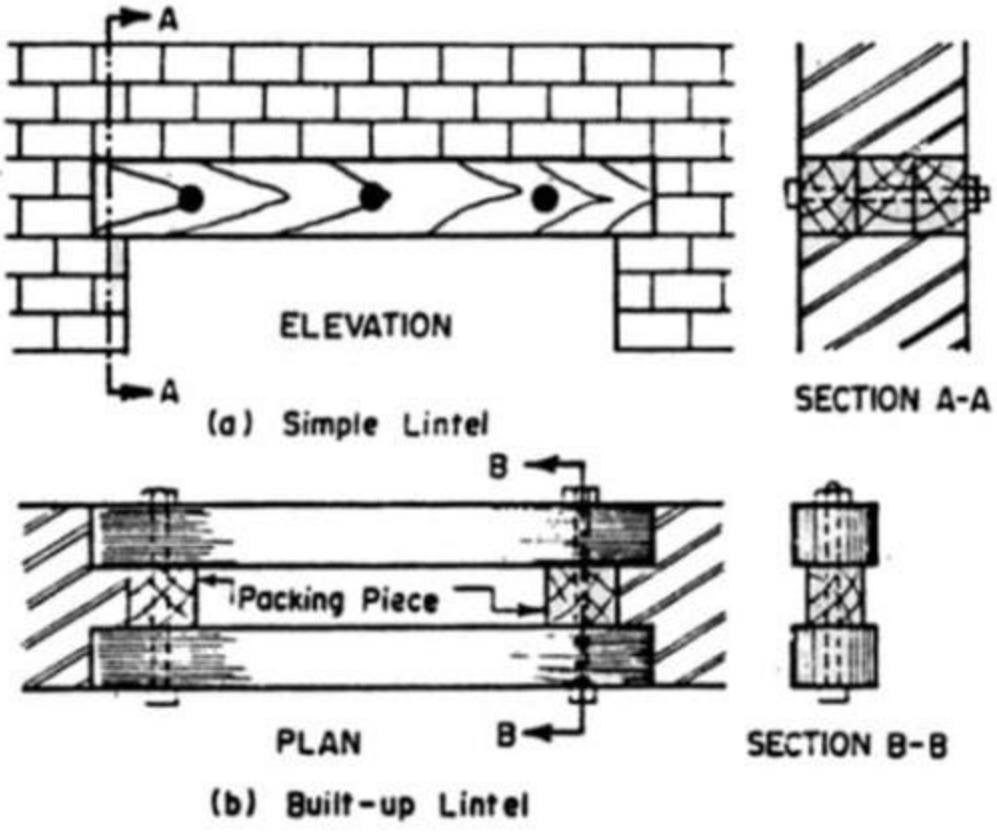
A lintel is a beam placed across the openings like doors, windows etc. in buildings to support the load from the structure above. Lintel is provided above the door and window to transfer the upward wall load to the surrounding wall. Lintel is generally made up of Reinforced concrete or cement mortar. The width of lintel beam is equal to the width of wall, and the ends of it is built into the wall. Lintels are classified based on their material of construction.

Types of Lintel used in Building Construction

1. Timber Lintel

In olden days of construction, Timber lintels were mostly used. But now a days they are replaced by several modern techniques, however in hilly areas these are using. The main disadvantages with timber are more cost and less durable and vulnerable to fire.

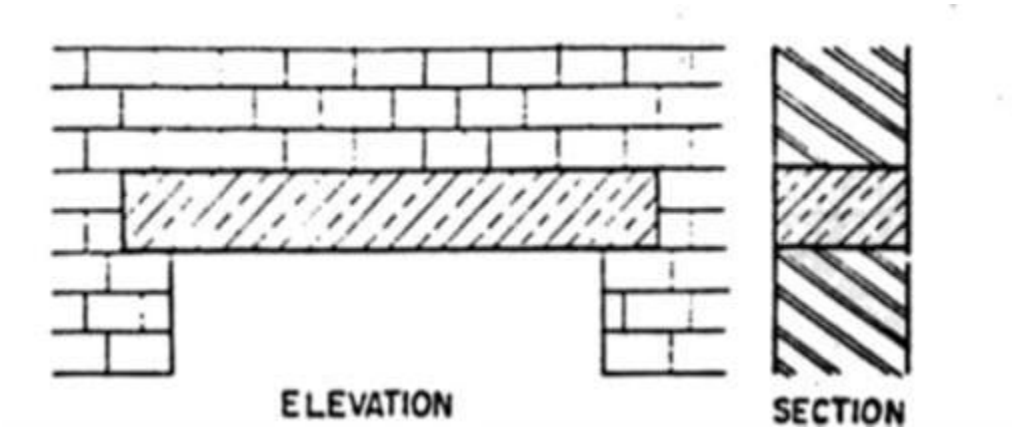
If the length of opening is more, then it is provided by joining multiple number of wooden pieces with the help of steel bolts which was shown in fig (a). In case of wider walls, it is composed of two wooden pieces kept at a distance with the help of packing pieces made of wood. Sometimes, these are strengthened by the provision of mild steel plates at their top and bottom, called as flitched lintels



2. Stone Lintel

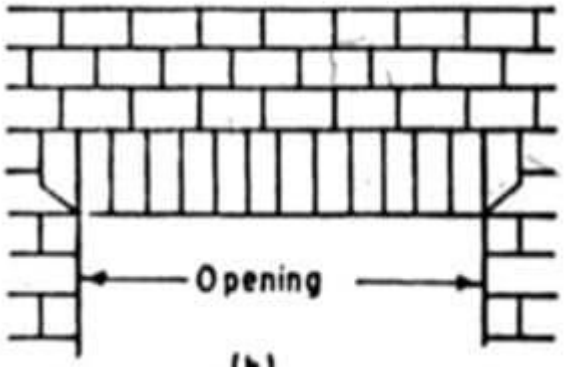
These are the most common type, especially where stone is abundantly available. The thickness of these are most important factor of its design. These are also provided over the openings in brick walls. Stone lintel is provided in the form of either one single piece or more than one piece.

The depth of this type is kept equal to 10 cm / meter of span, with a minimum value of 15 cm. They are used up to spans of 2 meters. In the structure is subjected to vibratory loads, cracks are formed in the stone lintel because of its weak tensile nature. Hence caution is needed.



3. Brick Lintel

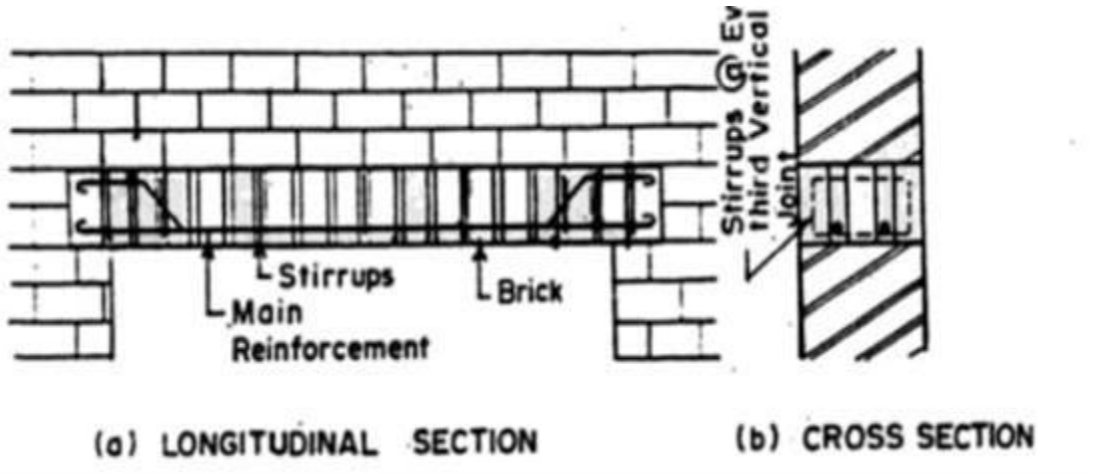
These are used when the opening is less than 1m and lesser loads are acting. Its depth varies from 10 cm to 20 cm, depending up on the span.



4. Reinforced Brick Lintel

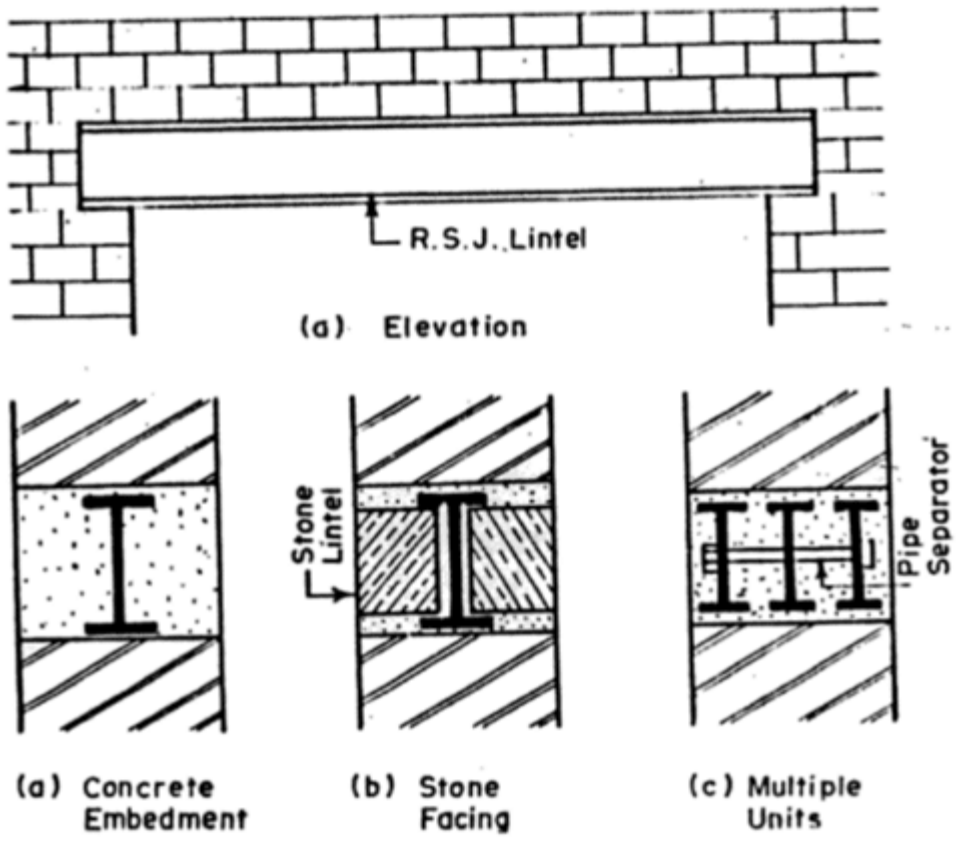
These are used when loads are heavy and span is greater than 1m. The depth of reinforced brick lintel should be equal to 10 cm or 15 cm or multiple of 10 cm. the bricks are so arranged that 2 to 3 cm wide space is left length wise between adjacent bricks for the insertion of mild steel bars as reinforcement. 1:3 cement mortar is used to fill up the gaps.

Vertical stirrups of 6 mm diameter are provided in every 3rd vertical joint. Main reinforcement is provided at the bottom consists 8 to 10 mm diameter bars, which are cranked up at the ends



5. Steel Lintel

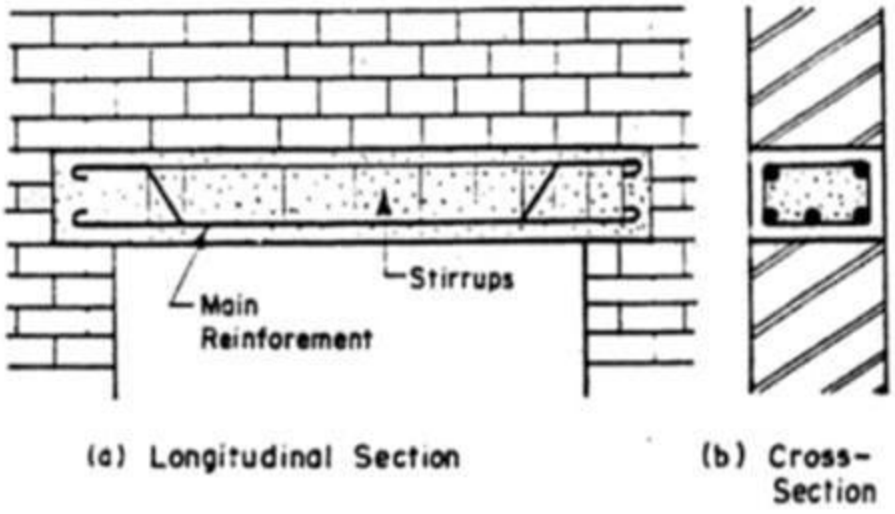
These are used when the superimposed loads are heavy and openings are large. These consist of channel sections or rolled steel joists. We can use one single section or in combinations depending up on the requirement.



6. Reinforced Cement Concrete Lintel

t present, the lintel made of reinforced concrete are widely used to span the openings for doors, windows, etc. in a structure because of their strength, rigidity, fire resistance, economy and ease

in construction. These are suitable for all the loads and for any span. The width is equal to width of wall and depth depends on length of span and magnitude of loading.



(a) Longitudinal Section (b) Cross-Section

Plinth Level | Sill Level

Plinth Level:-

The level at which Substructure ends and superstructure starts is called **Plinth level**. It is the part of the superstructure between natural ground level and Finished floor level. the plinth is provided to restrict the seepage of stormwater and rainwater into the building.

The plinth height is in between 300mm – 450 mm from ground level. It is recommended that the **minimum plinth height of 150 mm** is adopted from the top of the road.

Damp proof course (DPC) is laid on Plinth level. The purpose of applying DPC is to restrict the movement of moisture through walls and floors.

In Simple when you climb 3-4 steps to reach the building ground level is called Plinth height.

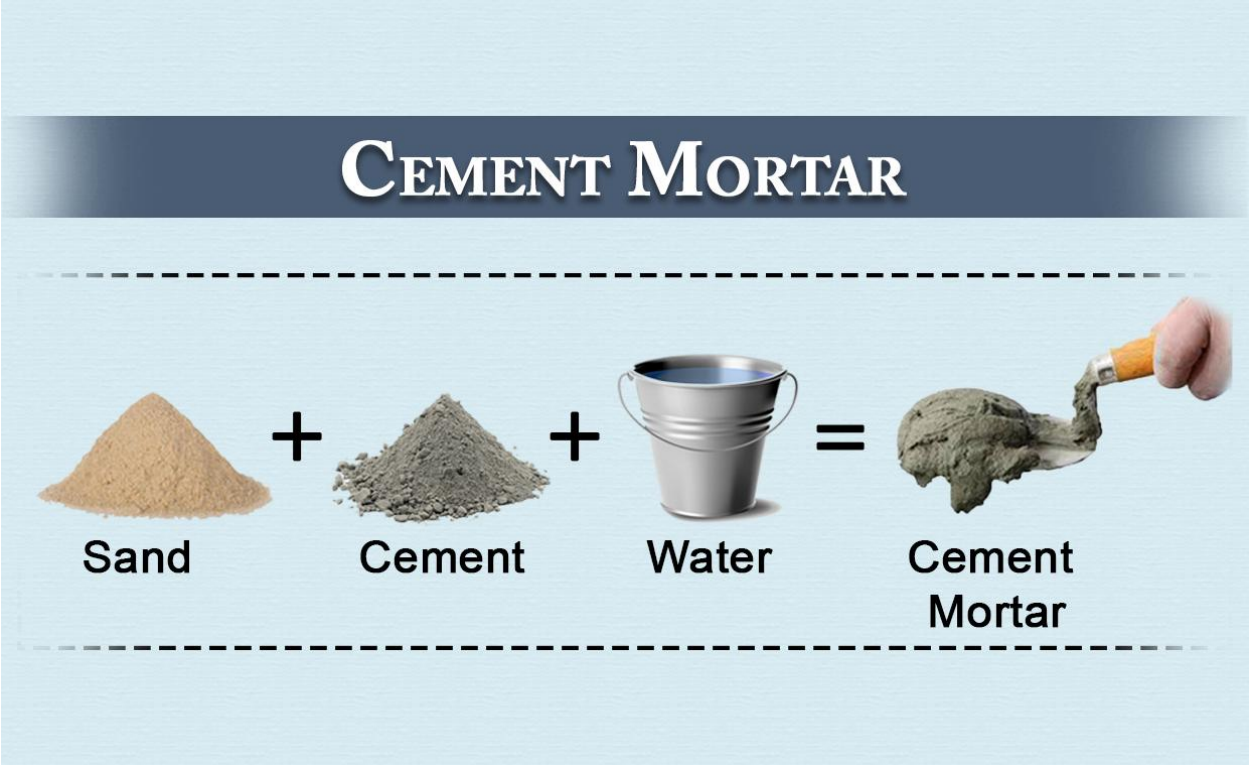
Sill level or Window Sill level:-

The level between the base portion of the window and portion of the floor above ground level (upwards) is called **Sill level.** Mortar bed or concrete bed is laid at the base of the window.

The height of sill level depends upon the type of room for bedroom & bathroom the height may kept around minimum 1100mm due to privacy concrens and in the living room the window sill level is kept at minimum 600-650mm from the floor level.

It is recommended that the **minimum sill level height of 44 inches**

Cement Mortar: Its Proportion, Preparation, and Uses



Mortar is a homogenous mixture of cement, sand and water. Different types of mortars are used in masonry construction based on their applications, binding materials, strength, bulk density and their purposes.

According to 'Frederick S. Merritt', (Author of Building Design and Construction Handbook), mortars are composed of a cementitious material, fine aggregate, sand, and specific amount of water. Mortar can be used for a number of purposes such as plastering over bricks or other forms of masonry, for flooring etc., and with the addition of coarse aggregate, it can also be used to make concrete. Cement mortar also provides a superior medium to create a smooth surface on walls made from bricks or other forms of masonry.

Proportion of Cement Mortar

The Proportion means the relative quantity of different components to be mixed to make good mortar, or simply the ratio between different materials.

Following are the proportions of cement mortar which is commonly recommended for different works:

01. Masonry Construction:

- For ordinary masonry work with brick/ stone as a structural unit. – **1:3** to **1:6**
- Forreinforced brick work – **1:2** to **1:3**.
- For all work in moist situations – **1:3**
- For Architectural work – **1:6**
- For **Load Bearing structures** – **1:3 or 1:4**

02. Plaster Work:

- For External Plaster and Ceiling Plaster – 1:4
- Internal Plaster (If sand is not fine i.e. Fineness Modulus> 3) – 1:5
- For Internal Plaster (if fine sand is available) – 1:6

Curing of Cement Mortar

Cement gains strength with hydration. So, it is necessary to see that the mortar remains wet until hydration occurs. After placing the mortar/concrete, the process of ensuring sufficient moisture for hydration is called curing. Curing is ensured by spraying water. Generally, curing begins 6–24 hours after using mortar. Initially, more water is required for hydration, which can be reduced gradually. Curing for cement mortar is recommended for 7 days.

PLAIN CEMENT CONCRETE

Plain cement concrete is the mixture of cement, fine aggregate(sand) and coarse aggregate without steel. PCC is an important component of a building which is laid on the soil surface to avoid direct contact of reinforcement of concrete with soil and water.

Material Used in Plain Cement Concrete

1. Coarse Aggregate

Coarse aggregate used in the PCC must be of hard broken stone of granite or similar stone, free from dust, dirt and other foreign matter. The stone shall be 20 mm in size and smaller. All the coarse material should be retained in a 5mm square mesh and should be well graded so that the voids do not exceed 42%.

2. Fine Aggregate

Fine aggregate shall be of coarse sand consisting of hard, sharp and angular grains and shall pass through a screen of 5 mm square mesh. Sand shall be of standard specifications, clean and free from dust, dirt and organic matter.

3. Cement

Portland Pozzolana cement (P.P.C) is normally used for plain cement concrete. It should conform to the specifications and shall have the required tensile and compressive stresses and fineness.

4. Water

Water used shall be clean and reasonably free from injurious quantities of deleterious materials such as oils, acids, alkalis, salts and vegetable growth. Generally, potable water shall be used having a pH value not less than 6.

Proportioning of Plain Cement Concrete

1. The proportioning is done based on the requirement or given specification. Generally 1:2:4 or 1:3:6 mix is used.

Reinforced Cement Concrete

Reinforced cement concrete (R.C.C) is the combination of ordinary concrete with the steel reinforcement to increase its compressive and tensile strength to a great extent.

Nature of Reinforced Cement Concrete:
The main principle in the preparation of the reinforced cement concrete is to make a structural material in which

(i) Steel serves the purpose of bearing the main tensile stresses;
(ii) concrete bears the main compressive forces, both acting in complete unison;
Some common types of reinforcement are:

(i) Mild Steel Bars:
This steel bar used as reinforcement can be commonly bent easily without cracking at the bends.

(ii) Hot Rolled Bars and Cold Worked Bars:
Hot Rolled Bars has a characteristic strength in tension which is almost double than that of mild steel bars.

They can be bent by heating (up to 100°C) without developing any defects.

Similarly, the cold worked steel bars come in twisted or stretched forms having elongated ribs or such structures along their length.

(iii) Steel Fabric:
This is made from a variety of bars and wires.

These may include plain round wires, indented and deformed wires, deformed steel bars of cold-worked type.

PRECAST CONCRETE

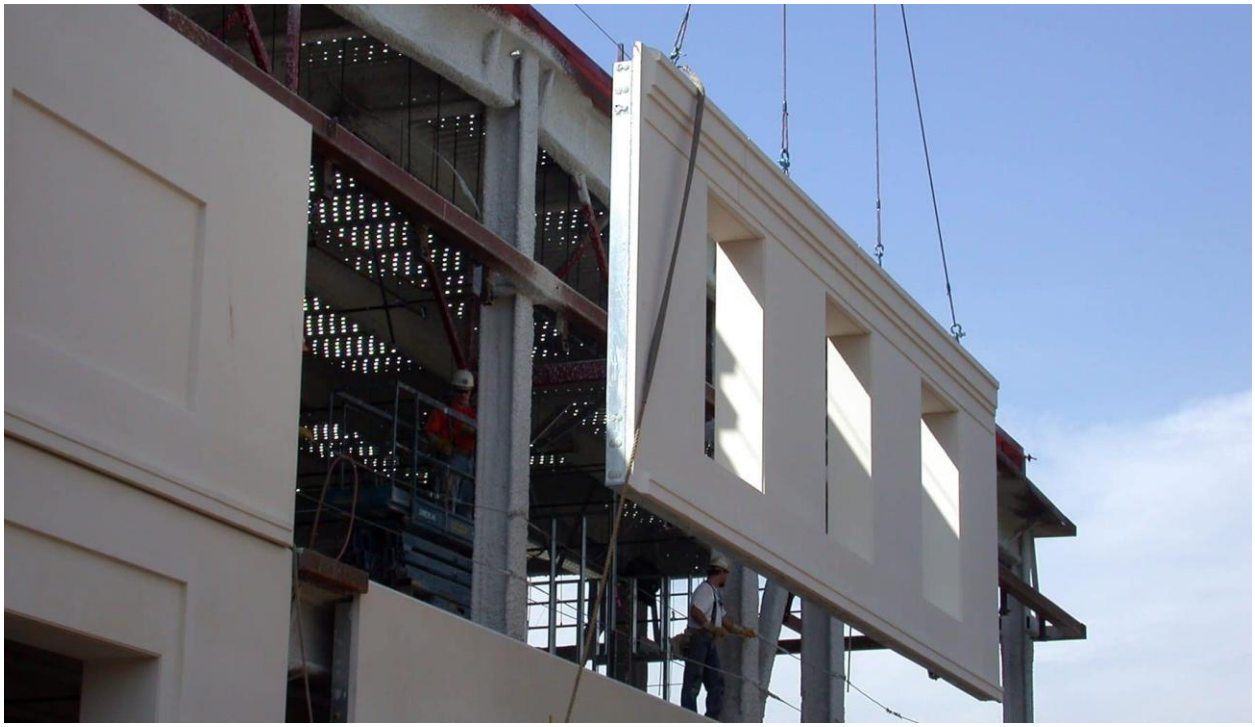
The form of construction where concrete is cast in a reusable mould and then cured in a controlled environment (precast plant) is called *precast concrete*. The casted structural member is then transported to the construction site and then erected. Structural members such as concrete frames, concrete walls, and concrete floors, etc. can be constructed using precast concrete.

Advantages of Precast Concrete

There are many precast concrete advantages. They are discussed below.

1. **Saves Construction Time**:.
2. **Quality Assurance**:
3. **Cost-effective**:.
4. **Durability**:
5. **Aesthetics**:
6. **Safe Construction Platform**

Photograph of precast concrete



Photograph of constructing precast building

STRUCTURAL STEEL

Structural Steel is a special kind of Steel. It is used for construction purposes. Due to its rigidity and high strength-to-weight ratio, structural Steel is mainly employed in buildings. Structural Steel is used in houses, warehouses, airplane hangars, educational facilities, bridges, stadiums, etc.

Structural Steel is Steel that contains carbon, not more than 2.1%. These are also called Carbon Steel, and structural Steel typically has a carbon content of less than 0.6%.

Properties of Structural Steel

- **Density**: The density of Structural Steel is 7750 to 8100 kg/m^3.
- **Young's Modulus of Elasticity:** Typical values for structural steel range from 190-210 GPa
- **Poisson's ratio**: For structural Steel, the acceptable value ranges from 0.27 to 0.3.
- **Tensile strength:** Structural Steel has high tensile strength, so it is preferred over other construction materials.
- **Yield strength:** The yield strength, also known as the yield point, is the stress at which an object permanently deforms. When stress is removed, it does not revert to its former shape. Carbon structural steel has a yield strength ranging from 187 to 758 MPa. The values of structural Steel constructed of alloys range from 366 to 1793 MPa.
- **Shear strength:** The shear strength of steel structure is specified at the failure under shear stress, and it is about 0.57 times the yield stress of structural Steel.
- **Hardness:** The resistance of an object to shape change when force is applied is referred to as hardness. There are three different types of hardness tests. Scratch, indentation, and rebound are all terms used to describe the process of scratching and indenting, and the hardness of structural Steel manufactured with alloys ranges from 149 to 627 kg. Carbon structural steels have a weight range of 86 to 388 kg.

Types of Structural Steel

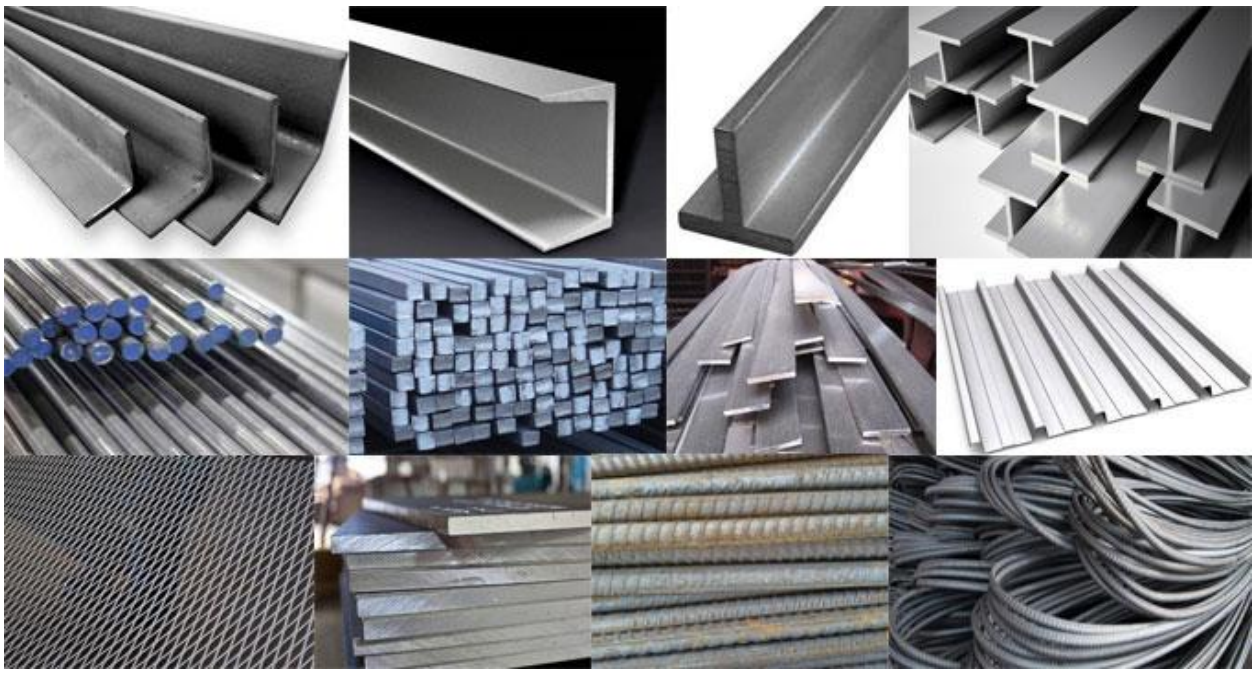
- **Carbon steel:** Steel in which the carbon content is upto 2% is known as carbon steel. The Specified ultimate tensile strength is 410 to 440 MPa, and the yield strength is 350 to 400 MPa.
- **High-strength carbon steel:** These steels are used in structures such as transmission lines and microwave towers. The specified ultimate tensile strength is 480 to 550 MPa, and the yield strength is 350 to 400 MPa.
- **Medium and high strength micro-alloyed steel:** Alloys such as chromium, nickel, molybdenum, etc., are used to increase the strength while retaining the desired ductility. The specified ultimate tensile strength is 440 to 590 MPa, and the yield strength is 300 to 450 MPa.
- **High strength quenched and tempered Steel: Heat treatment increases strength in** this type of Steel. The specified ultimate tensile strength is 440 to 590 MPa; the yield strength is 300 to 450 MPa.

- **Weathering Steel:** These are corrosion-resistant Steel and are often not Painted. The specified ultimate tensile strength is 480 MPa, and the yield strength is 350 MPa.
- **Fire-resistant Steel:** These steels are also known as thermo mechanically treated (TMT) steel and are used where the structures are more prone to fire.

Types of Steel Sections

Structural steel members are fabricated in factories according to their intended use. Continuous casting molds are used to cast rolled steel parts with no joints. The following sections describe the various shapes and forms of rolled steel sections.

1. Rolled Steel I-sections (Beam sections).
2. Rolled Steel Channel Sections.
3. Rolled Steel Tee Sections.
4. Rolled Steel Angles Sections.
5. Rolled Steel Bars.
6. Rolled Steel Tubes.
7. Rolled Steel Flats.
8. Rolled Steel Sheets



Photograph of different types of steel sections

Different Types of Construction Chemicals

Construction chemicals have always been playing important roles in virtually all sorts of construction projects, be it industrial projects, residential building projects, commercial building projects and so on. These chemicals are often used in various elements of projects in order to achieve various important qualities such as workability, durability etc. Construction chemicals exist in many varieties from a large number of manufacturers worldwide.

Concrete curing compounds

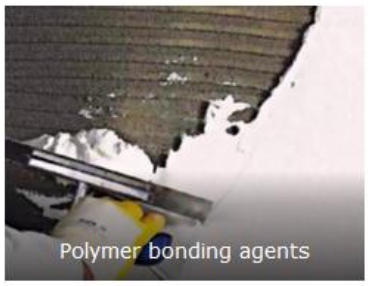
Concrete curing compound consists essentially of waxes, natural and synthetic resins, and solvents of high volatility at atmospheric temperatures. The compound forms a moisture retentive film shortly after being applied on a fresh concrete surface.

Polymer bonding agents

Polymer Bonding Agent is an aqueous emulsion of a polymer and chemical admixtures. It is designed for use as a bonding agent with concrete and cement-based products in interior or exterior applications.

Mould releasing agents

Mould release agents come in handy when you have materials that are shaped and constructed in moulds. Without the releasing agent, your mould may become damaged or even break when it is time to remove it.



Form release agents

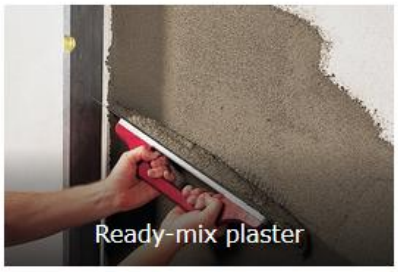
These compounds are applied on the inner surfaces of forms, not only facilitate stripping of formwork but also render concrete surfaces smoother. They also help enhance the life-span of the forms. Form releasing agents can be oil based, resin based, water based, organic chemical based etc.

Concrete floor hardeners

These are chemicals added in floor concrete in order to render it denser and more durable. They also usually enhance chemical resistance, impact & abrasion resistance, waterproofing capability etc. besides reducing dusting.

Tile fixing

Tile fixers and tile adhesives form the backbone of your home. A quality tile fixer connects all your tiles together, to create a beautiful canvas from individual pieces. Tile fixing products are used for floorings, bathtubs, washbasins, kitchen tops and any other area where two surfaces need to stick together.



Waterproofing chemicals

These chemicals can be quite useful when a structure's waterproofing capability is to be given a boost which is especially required for structures constantly dealing with liquids. There are many varieties.

Adhesives

These construction chemicals are readily used in all sorts of projects, be it commercial, residential, industrial etc. construction projects. Adhesives are expected to have strong bonding capacity besides good waterproofing, weatherproofing etc. qualities.

COLUMNS

The most commonly encountered compression member in building constructions is a column. A column is a compression member that transfers load from beam and slab to the structure's foundation. The IS code refers to the column as a compression member, with an effective length 3 times the least lateral dimension.

What are the Different Types of Columns?

There are many distinct kinds of columns that are utilised in various portions of construction. A column is a vertical structural component that primarily supports compression loads. It may distribute the weight from a beam to a floor or foundations, or from a ceiling, floor slab, roof slab, or other slabs. The bending moments about one or both of the cross-section axes are frequently present in columns. The different types of columns based on several factors are listed below.

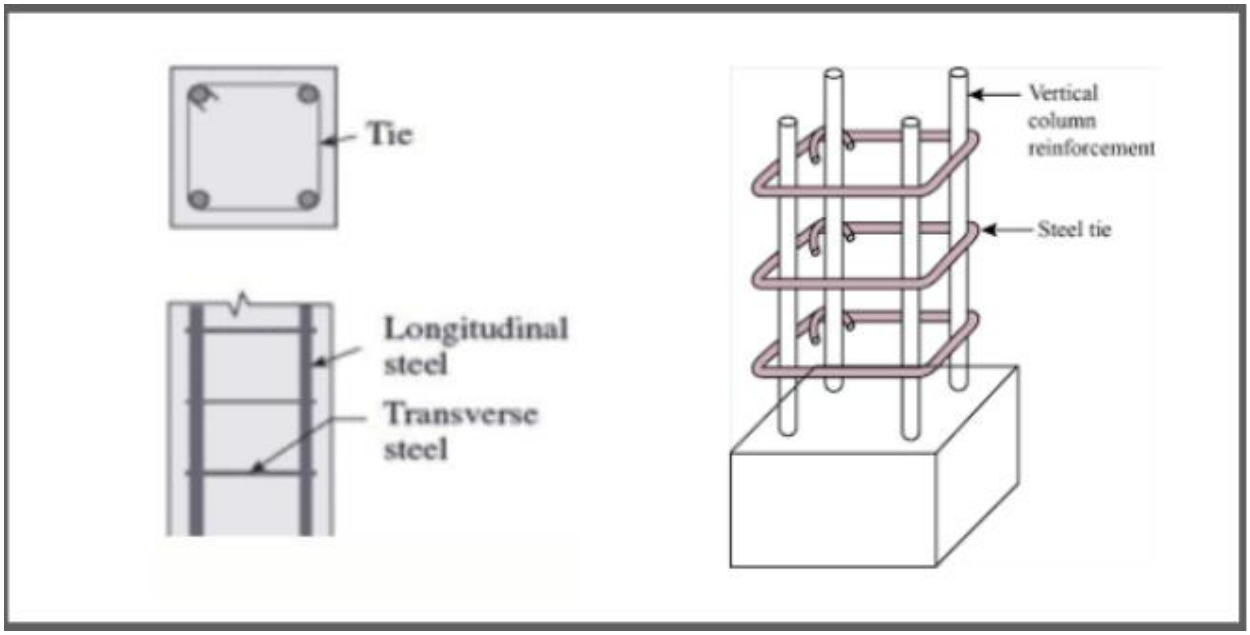
- Based on shape
- Based on the type of reinforcement
- Based on the type of loading
- Based on the slenderness ratio
- Based on the type of material

Types of Columns Based on Shape

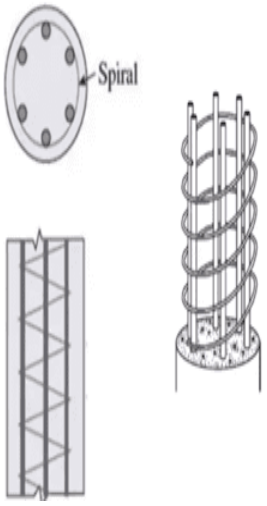
- **Square/Rectangular columns-** These are generally used in building constructions. Due to the ease of shuttering and reinforcement placement, these types of columns are both cost-effective and simple to construct.
- **Circular columns-** Circular columns are commonly used in piling and elevation of buildings. It is also used as bridge pillars. They provide better bending resistance than square or rectangular column
- **L-type columns-** These types of columns are commonly used at the corners of boundary walls.
- **T-type columns-** These types of columns are quite commonly used in bridge construction.
- **Y-type columns-** They are used in bridge and flyover construction

Types of Columns Based on the Type of Reinforcement

Tied Columns- These are the types of columns in which the main longitudinal bars are enclosed within closely and uniformly spaced lateral ties. These are the most commonly used types of reinforced columns



- **Spiral Columns-** In these types of columns, the main longitudinal bars are confined within continuously wound spiral reinforcement. The spiral reinforcements provide lateral support and delay failure due to axial load.



- **Composite Columns-** These are the types of columns where the reinforcement is in the form of structural steel sections or pipes with or without longitudinal bars.

Types of Columns Based on the Slenderness Ratio

The slenderness ratio of a compression member is defined as the ratio of its effective length to its lateral dimensions. It provides a measure of the column's susceptibility to buckling failure. Columns can be divided into two types of columns based on the slenderness ratio.

- **Short column-** The column is referred to as a short column if the ratio of the effective length of the column to the least lateral dimension is less than 12. The failure of a short column is due to crushing (pure compression failure).
- **Long columns-** A long column is defined as one in which the ratio of the effective length of the column to the least lateral dimension is more than 12. Bending or buckling is how a long column fails.

SLABS

What is a concrete slab?

A concrete slab is one of the structural members of buildings or infrastructure. The slab is constructed generally in uniform thickness, but it may vary in some cases. The slab is usually constructed with concrete ingredients. It consists of coarse aggregate, fine aggregate, cement material and structural steel. Steel-reinforced slabs, typically between 100 and 500 mm thick, are most often used to construct floors and ceilings

Why is a concrete slab constructed?

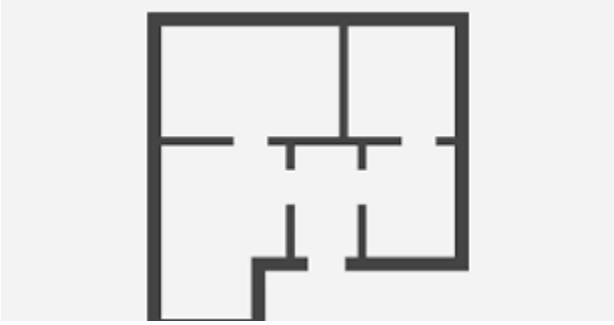
The concrete slab is constructed the supporting the walls, beams and columns of the structures. It plays an important role in the structures. It is usually constructed with uniform thickness, but it may be constructed with varying thicknesses.

Classification of slabs

Slabs are generally classified into one-way slab and two-way slab. The former is supported on two sides and the ratio of long to short span is greater than two. However, the latter is supported on four sides and the ratio of long to short span is smaller than two.

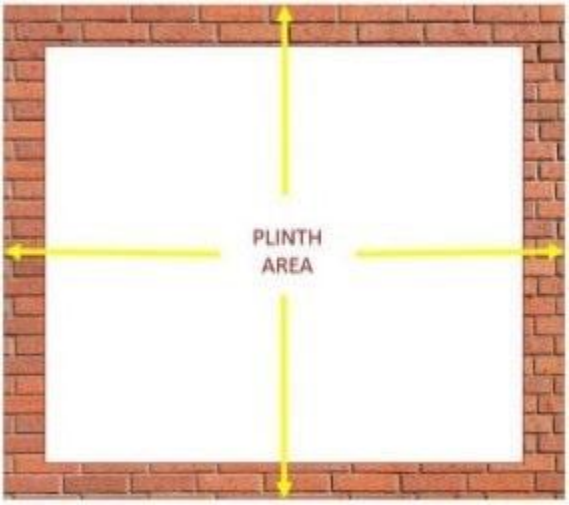
PLINTH AREA AND CARPET AREA

How do you calculate plinth area?

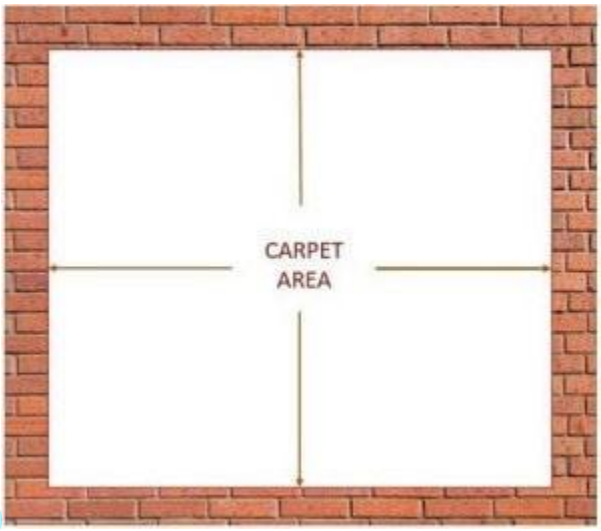


Plinth area = building carpet area + wall area (both internal and exterior walls) + parasitic area + elevator openings, etc. The plinth area is the space between the building's exterior and outer bounds or its walls. The carpet area is the sum of the actual areas of the rooms that you can carpet.

Plinth area and carpet area of a building is measured for estimation and calculation of building cost. It is also a measure of usable space of building. **Plinth area** is the covered built-up area measured at the floor level of any storey or at the floor level of the basement. Plinth area is also called as built-up area and is the entire area occupied by the building including internal and external walls. Plinth area is generally 10-20% more than carpet area.



Carpet area the covered area of the usable spaces of rooms at any floor. It is measured between walls to walls within the building and is the sum of the actual areas of the rooms where you can carpet



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BEAMS

A beam is a structural element or member that largely transfers loads placed along its axis to its supports, such as walls, columns, foundations, and so on, with bending being the primary way of deflections

TYPES OF BEAM

1.SimplySupportedBeam:

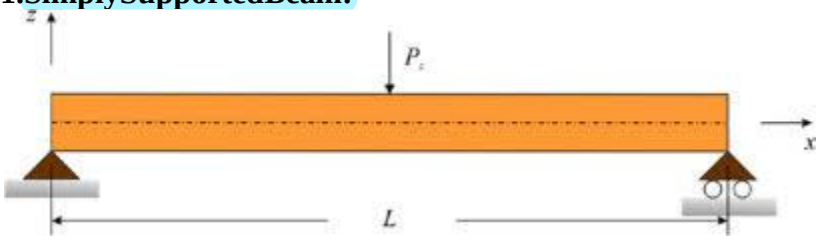

Fig1:SimplySupportedBeam

It is one of the most basic structural elements because both ends are supported, but it can rotate freely. There are pinned support at one end, and at the other, there is roller support. It can withstand shearing and bend depending on the strain.

2.CantileverBeam:

Fig2:CantileverBeam

A cantilever beam is defined as a fastened beam at one end and set to be free at the other. The load is distributed back to the support, subjected to moment and shear stress. Bay windows, balconies, and some bridges are all possible using cantilever beams.

3.FixedBeam:

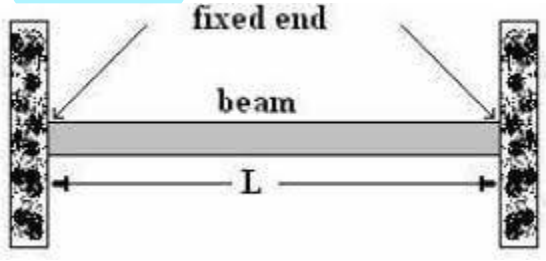

Fig 3: Fixed Beam

This type of beam has fixed ends on both ends. In addition, the fixed beam's rotating movement is controlled. The fixed beam's end cannot be rotated because it is fixed at both ends. The fixed beam is positioned to withstand high pressure. There is no reaction from this type of beam. It is employed in the construction of high-rise buildings and industrial structures.

4.OverhangingBeam:

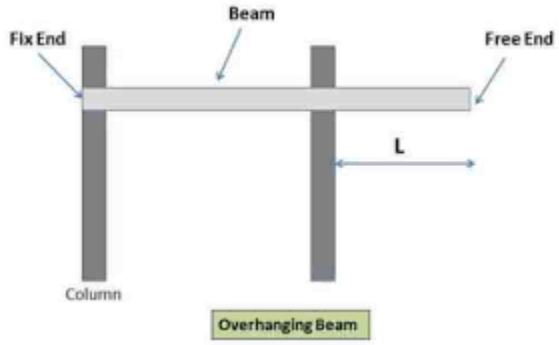

Fig4:OverhangingBeam

A simple supporting beam-like structure is commonly used for this sort of beam. In an overhanging beam, however, one end extends beyond the support. The beam is often delivered at each end of the column to transfer the load. A column supports one end of an overhanging beam, while the other is overhung away from the support. In residential buildings, overhanging beams are typically employed to create shade or balconies. Both ends of the Double Overhanging Beam overhang somewhat away from the support.

5.ContinuousBeam:

Fig5:ContinuousBeam

A continuous beam contains more than two or more supports. It's similar to a supported beam. When a beam is maintained at both ends with intermediate support, it is referred to as a continuous beam. There are multiple spans in these types of beams. In bridge construction, a continuous beam is most usually employed. This sort of beam has more than two supports running its length.