



SNS COLLEGE OF TECHNOLOGY



AN AUTONOMOUS INSTITUTION

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COIMBATORE

DEPARTMENT OF CIVIL ENGINEERING

23GET102 – BASIC CIVIL AND MECHANICAL ENGINEERING

I YEAR / I SEMESTER

Unit 1 : Civil Engineering Materials and Surveying

Topic : Bricks and Classification



Bricks

- A **brick** is a type of block used to build walls, pavements and other elements in masonry construction.
- Properly, the term *brick* denotes a block composed of dried clay, but is now also used informally to denote other chemically cured construction blocks.
- Bricks can be joined together using mortar, adhesives or by interlocking them.
- Bricks are produced in numerous classes, types, materials, and sizes which vary with region and time period, and are produced in bulk quantities.



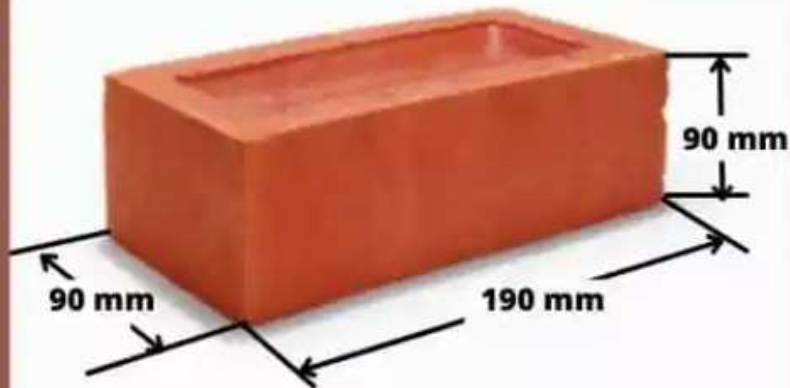
Bricks



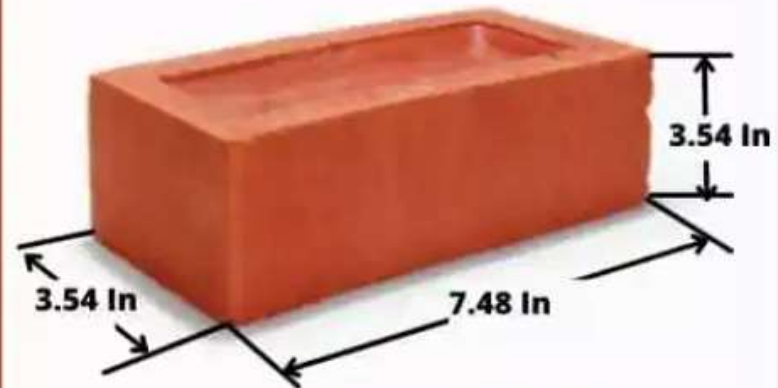


Size of Bricks

What Is Standard Size of Brick In India



**Standard Size of
Brick in mm**



**Standard Size of
Brick in Inches**



Frog



- Frog is an indentation or depression on the top face of a brick made with the object of forming a key for the mortars. This reduces the weight of the bricks also.
- It is kept on the top face while constructing a wall so that mortar is filled properly in it.
 - Size of frog = 100mmx40mmx10mm
 - Depth of frog = 10mm to 20mm

Purpose of frog:

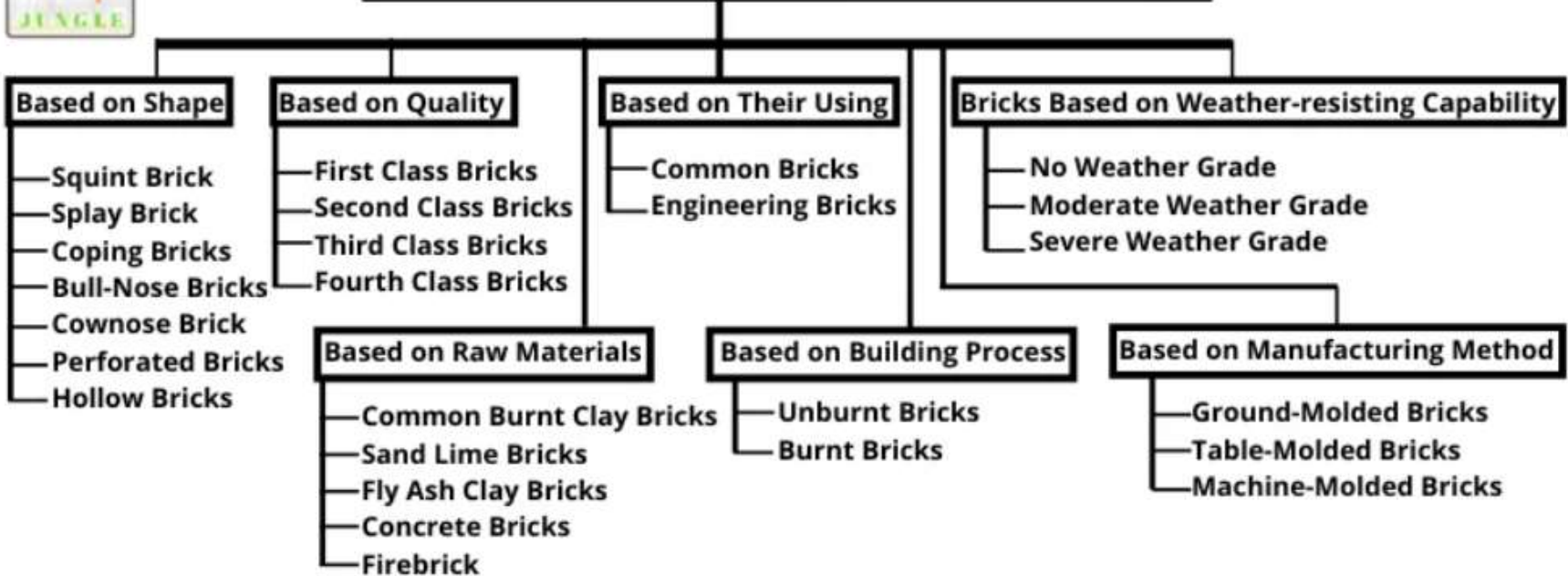
- It will provide a key for holding mortar in brick masonry.
- It can be used for branding purpose.



Classification of Bricks



Classification of Bricks Different Base

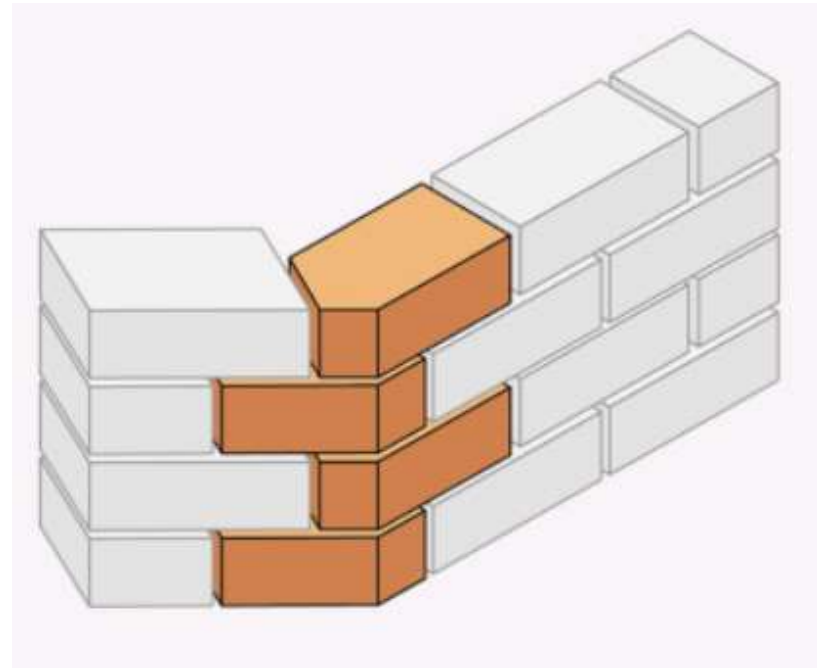
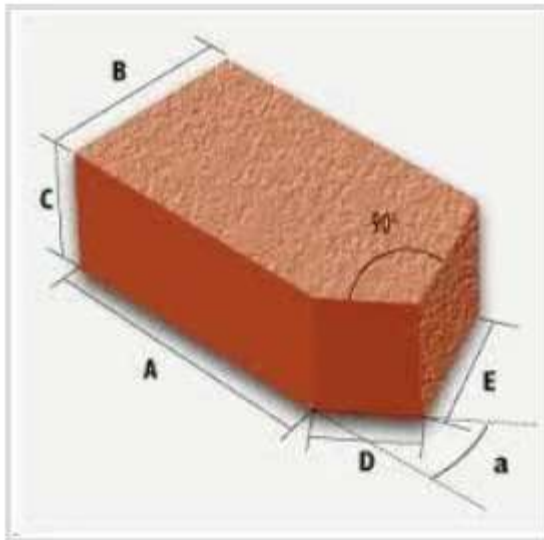




Based on Shape

Squint Brick:

- They are cut at a corner at an angle of more than 90 degrees.
- They are required to shape the outer or inner corner in a wall.

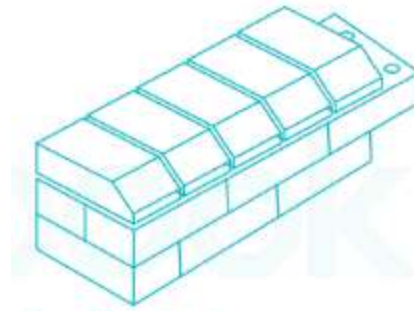




Based on Shape

Splay Brick:

- They have a level or part, width-wise, length, or in both directions.
- These are used in door and window jambs and in plinths.

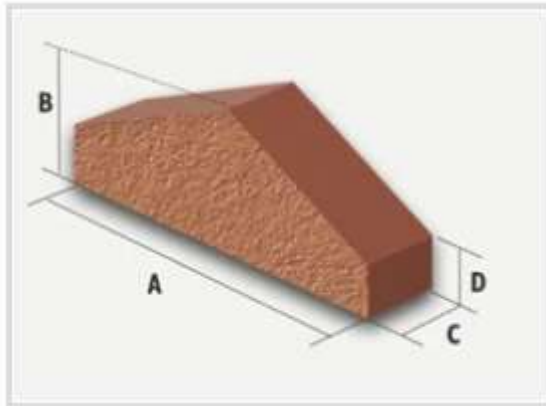




Based on Shape

Coping Bricks:

- They are used for coping on the walls to give them a good appearance and can also be used for easy drainage of water.
- When a coping is to be provided to a wall, a particular shape may be desired.





Based on Shape

Bull-Nose Bricks:

- These bricks have rounded corners and are usually preferred in buildings from an architectural point of view.
- They are mostly used in the construction of steps, sills, and capping walls.
- It is a standard brick with one edge rounded.

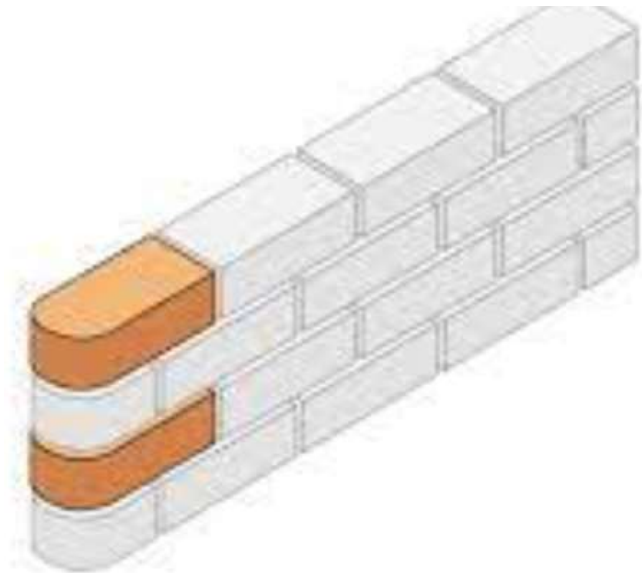
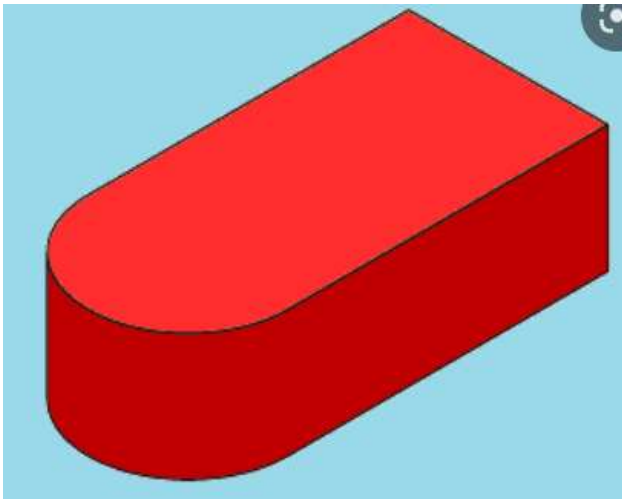




Based on Shape

Cownose Brick:

- It is similar to the bullnose, but it has both sides rounded to one side.
- It can also be called double bullnose bricks.
- They have the same use as bullnose, but they only give additional roundness.

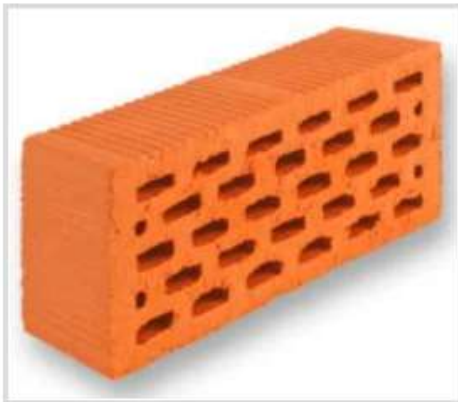




Based on Shape

Perforated Bricks:

- These bricks have holes, produced by pushing iron bars within the bricks.
- The purpose of producing these holes is to reduce the overall weight of the brick, thus minimizing the self-weight of the structure.
- However, these bricks do transmit sound and are also not suitable to be used in the hydraulic structures.

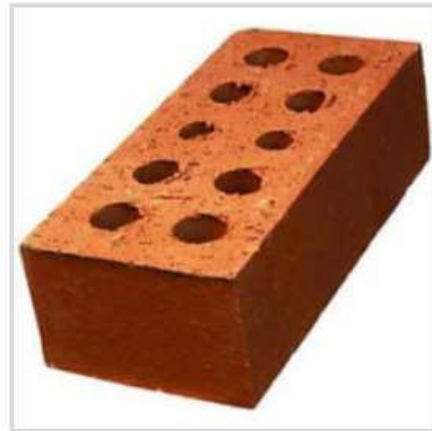




Based on Shape

Hollow Bricks:

- These bricks are used for insulation purposes.
- They are strong against distributed loads; however, they may easily fail against concentrated loads.
- They are different from perforated brick as a number of holes in the hollow brick are less, but the size of holes is bigger as compared to those in perforated bricks.





Based on Quality

First Class Bricks:

- These are the high-quality bricks, having a uniform shape.
- Color and texture. They have sharp edges. They are sound and well burnt.
- If scratched with a nail, they leave no mark.
- Moreover, if struck against each other, a clear metallic sound is produced.
- They are free from efflorescence, cracks and other flaws.
- The crushing strength of these bricks is approximately 105 kg/cm^2 .
- The water absorption after 24 hours in the water is no more than 10- 15 percent by mass of the brick.
- Owing to the highest quality, they are used in load-bearing walls and pavements.



Based on Quality

Second Class Bricks:

- Although sound and well burnt, the second class bricks have certain irregularities in shape and texture.
- Like first class bricks, they are also free from cracks, considerable efflorescence, and flaws.
- The water absorption after 24 hours in the water is about 20 percent by mass of the brick.
- They are also used in load bearing walls but of moderate capacity, usually in single-story buildings.
- However, they are widely used in partition walls.
- Moreover, they are preferred as brick ballast in foundations and floorings.



Based on Quality

Third Class Bricks:

- Slightly under burnt bricks are termed as third-class
- They are not uniform in shape and size.
- Their crushing strength is about 30 kg/cm^2 far below than that of first-class bricks.
- The water absorption is about 25 percent by mass of the brick after 24 hours of submersion in water.
- They produce a dull sound when struck against each other.
- Though they have poor strength and texture, yet they are highly economical and can be used in the construction of temporary and rural structures.



Based on Quality

Fourth Class Bricks:

- They are slightly over burnt thus have very low strength and are not recommended for application in major construction works.
- However, they can be used in flooring, and inferior construction works.



Based on Using

Common Bricks:

- These bricks are the most common bricks used.
- They don't have any special features or requirements.
- They have low resistance, low quality, low compressive strength.
- They are usually used on the interior walls.





Based on Using

Engineering Bricks:

- Engineering bricks are bricks manufactured at extremely high temperatures, forming a dense and strong brick, allowing the brick to limit strength and water absorption.
- Engineering bricks offer excellent load bearing capacity damp-proof characteristics and chemical resisting properties.





Based on Raw Materials

Common Burnt Clay Bricks :

- Common burnt clay bricks are formed by pressing in molds.
- Then these bricks are dried and fired in a kiln.
- Common burnt clay bricks are used in general work with no special attractive appearances.
- When these bricks are used in walls, they require plastering or rendering.





Based on Raw Materials

Sand Lime Bricks :

- Sand-lime bricks are made by mixing sand, fly ash and lime followed by a chemical process during wet mixing.
- The mix is then molded under pressure forming the brick.
- These bricks can offer advantages over clay bricks such as their color appearance is grey instead of the regular reddish color.
- Their shape is uniform and presents a smoother finish that doesn't require plastering.
- These bricks offer excellent strength as a load-bearing member.

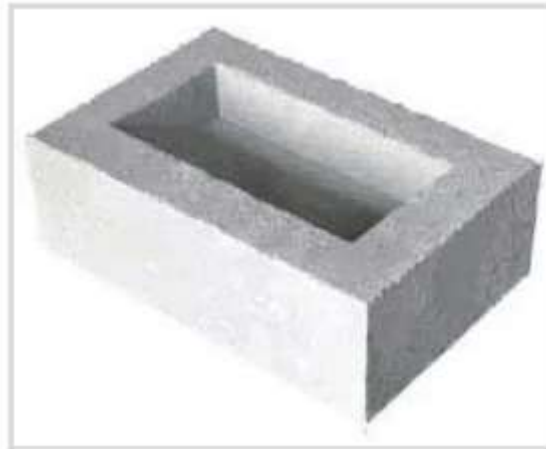




Based on Raw Materials

Fly Ash Clay Bricks:

- Fly ash clay bricks are manufactured with clay and fly ash, at about 1,000 degrees C.
- Some studies have shown that these bricks tend to fail poor produce pop-outs, when bricks come into contact with moisture and water, causing the bricks to expand.





Based on Raw Materials

Concrete Bricks:

- It is made of concrete. It is the least used bricks. It has low compression strength and is of low quality.
- These bricks are used above and below the damp proof course.
- These bricks are used can be used for fences and internal brick-works because of their sound reductions and heat resistance qualities. It is also called mortar brick.
- It can be of different colors if the pigment is added during manufacturing. It should not be used below ground.





Based on Raw Materials

Firebrick:

- It is also known as refractory bricks. It is manufactured from a specially designed earth.
- After burning, it can withstand very high temperatures without affecting its shape, size, and strength.
- It is used for the lining of chimney and furnaces where the usual temperature is expected to be very high.





Based on Building Process

Unburnt Bricks:

- Unburn or sun-dried with the help of heat received from the sun after the process of molding.
- These bricks can only be used in the construction of temporary and cheap structures.
- Such bricks should not be used in places exposed to heavy rains.





Based on Building Process

Burnt Bricks:

- Burnt bricks are made by burning them in the kiln.
- First-class, Second Class, Third Class bricks are burnt bricks.





Based on Manufacturing Method

Ground-Moulded Bricks :

- The ground is first made level and fine sand is sprinkled over it.
- Mould is dipped in water and placed over the ground to fill the clay.
- Extra clay is removed by wooden or metal strike after the mold is filled forced mold is then lifted up and raw brick is left on the ground.
- Mould is then dipped in water every time lower faces of ground molded bricks are rough and it is not possible to place the frog on such bricks.



Based on Manufacturing Method

Table-Moulded Bricks:

- Molding is done on a table of size 1m x 2m with the help of hands, molds and various tools.



Based on Manufacturing Method

Machine-Moulded Bricks:

- The molding of bricks is carried out with the help of a machine.
- This method results in better shape and a high production rate.
- This approach is used when a larger number of bricks are required in a very limited time span.



Based on Weather Resisting Capability



1. No Weather Grade:

These bricks do not have any weather resisting capabilities and used on the inside walls.

2. Moderate Weather Grade:

These types of bricks are used in tropical countries. They can withstand any high temperature.

3. Severe Weather Grade:

These types of bricks are used in the countries which are covered in snow most of the time of year. These bricks are resistant to any kind of freeze-thaw actions.



Thank You!!



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DEPARTMENT OF CIVIL ENGINEERING

23GET102 – BASIC CIVIL AND MECHANICAL ENGINEERING

I YEAR / I SEMESTER

Unit 1 : Civil Engineering Materials and Surveying

Topic : Manufacturing of Clay Bricks



Manufacturing of Bricks

- The process of manufacturing of bricks from clay involves preparation of clay, molding and then drying and burning of bricks.
- The bricks are building materials which are generally available as rectangular blocks.
- The bricks do not require any dressing and brick laying is very simple compared to stone masonry.



Site Selection of Manufacturing of Bricks



For the manufacturing of bricks, the site should be selected based on some important considerations such as:

- The ground should be of plain surface.
- The site should be connected with communicating roads for transporting materials etc.,
- Good brick earth should be easily available.
- The site should offer all facilities to the workers.



Composition of Clay Bricks

Ingredient	Percentage in brick
Silica (SiO_2)	55%
Alumina (Al_2O_3)	30%
Iron Oxide (Fe_2O_3)	8%
Magnesia (MgO)	5%
Lime(CaO)	1%
Organic Matter	1%



Manufacturing Process of Bricks

- There are four different operations are involved in the process of manufacturing of bricks:
 1. Preparation of clay
 2. Molding
 3. Drying
 4. Burning



Preparation of Clay

The clay for bricks is prepared in the following order:

- ❖ Un-soiling
- ❖ Digging
- ❖ Cleaning
- ❖ Weathering
- ❖ Blending
- ❖ Tempering



Preparation of Clay

(i) Un-Soiling of clay:

- We need pure clay for the preparation of bricks.
- The top layer of soil may contains impurities, so the clay in top layer of soil about 200mm depth is thrown away. This is called unsoiling.

(ii) Digging:

- The clay is then dug out from the ground.
- It is spread on the levelled ground, just a little deeper than the general level of ground.
- The height of heaps of clay is about 600 mm to 1200 mm.



Preparation of Clay

(iii) Cleaning:

- In this stage, the clay is cleaned of stones, vegetable matter etc. if large quantity of particulate matter is present, then the clay is washed and screened.
- The lumps of clay are converted into powder with earth crushing rollers.

(iv) Weathering:

- The cleaned clay is exposed to atmosphere for softening.
- The period of weathering may be 3 to 4 weeks or a full rainy season.
- Generally, the clay is dug out just before the rainy season for larger projects.



Preparation of Clay

(v) Blending:

- If we want to add any ingredient to the clay, it is to be added in this stage by making the clay loose and spread the ingredient over it.
- Then take small portion of clay into the hands and turning it up and down in vertical direction. This process is called blending of clay.



Preparation of Clay

(vi) Tempering:

- In this stage, water is added to clay and pressed or mixed.
- The pressing will be done by cattle or with feet of men for small scale projects, pug mill is used as grinder for large scale projects.
- So, the clay obtains the plastic nature and now it is suitable for molding.

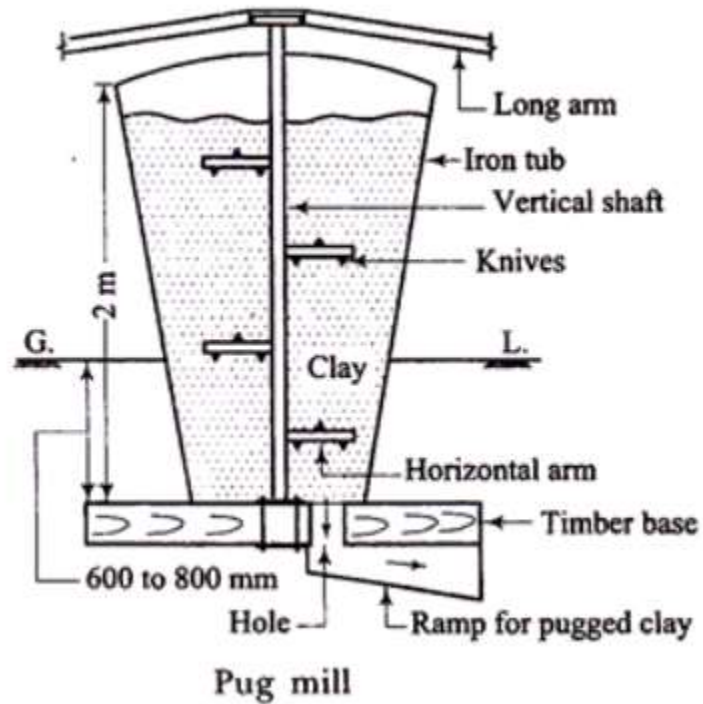


Pug Mill





Preparation of Clay





Preparation of Clay





Preparation of Clay





Molding of Clay

In the molding process, prepared clay is mold into brick shape (generally rectangular). This process can be done in two ways according to scale of project.

1. Hand molding (for small scale)
2. Machine molding (for large scale)



Molding of Clay

Hand molding of bricks

- If manufacturing of bricks is on a small scale and manpower is also cheap then we can go for hand molding.
 - The molds are in rectangular shape made of wood or steel which are opened at the top and bottom.
 - If we take durability in consideration steel molds are better than wooden molds.
- In hand molding again there are two types and they are

1. Ground molded bricks
2. Table-molded bricks



Molding of Clay





Molding of Clay

Ground molded bricks:

- In this process of ground molding, first level the ground and sand or ash is sprinkled over it.
- Now place the wet mold in the ground and filled it with tempered clay and press hard to fill all corners of the mold. Extra clay is removed with metal strike or wood strike or with wire.
- The mold is then lifted up and we have raw brick in the ground. And again wet the mold by dipping it in water and repeat the same process. The process of dipping mold every time to make bricks is called **slop molding**.



Molding of Clay

- Sometimes, the inside surface of mold is sprinkled with sand or ash instead of dipping in water this is called **sand molding**.
- Frog mark means the mark of depth which is placed on raw brick while molding. The depth may be 10mm to 20mm.
- Frog mark acts as the trademark of manufacturing company and also it is useful to store mortar in it when the bricks are placed over it.



Molding of Clay





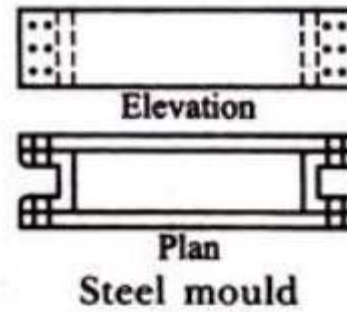
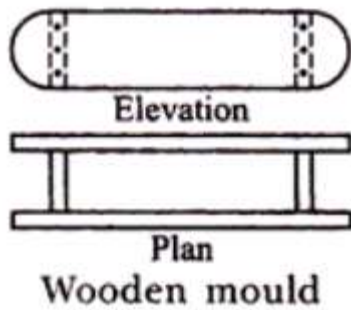
Molding of Clay

Table molded bricks

- This process is similar to ground molding process, but here the bricks are molded on the table of size 2m x 1m.
- Ground molding is economical when compared to table molding.



Molding of Clay





Molding of Clay

Machine molding of bricks

The bricks required are in large quantity, then machine molding is economical and also saves more time. Here also we are having two types of machines,

1. Plastic clay machines
2. Dry clay machines



Molding of Clay

Plastic clay machines

- This machines contain an opening in rectangular shape and when we place the tempered clay in to this machine it will come out through this opening.
- Now, the rectangular strips coming out the opening are cut by wires to get required thickness of brick.
- So, these are also called **wire cut bricks**. Now these raw bricks are ready for the drying process.



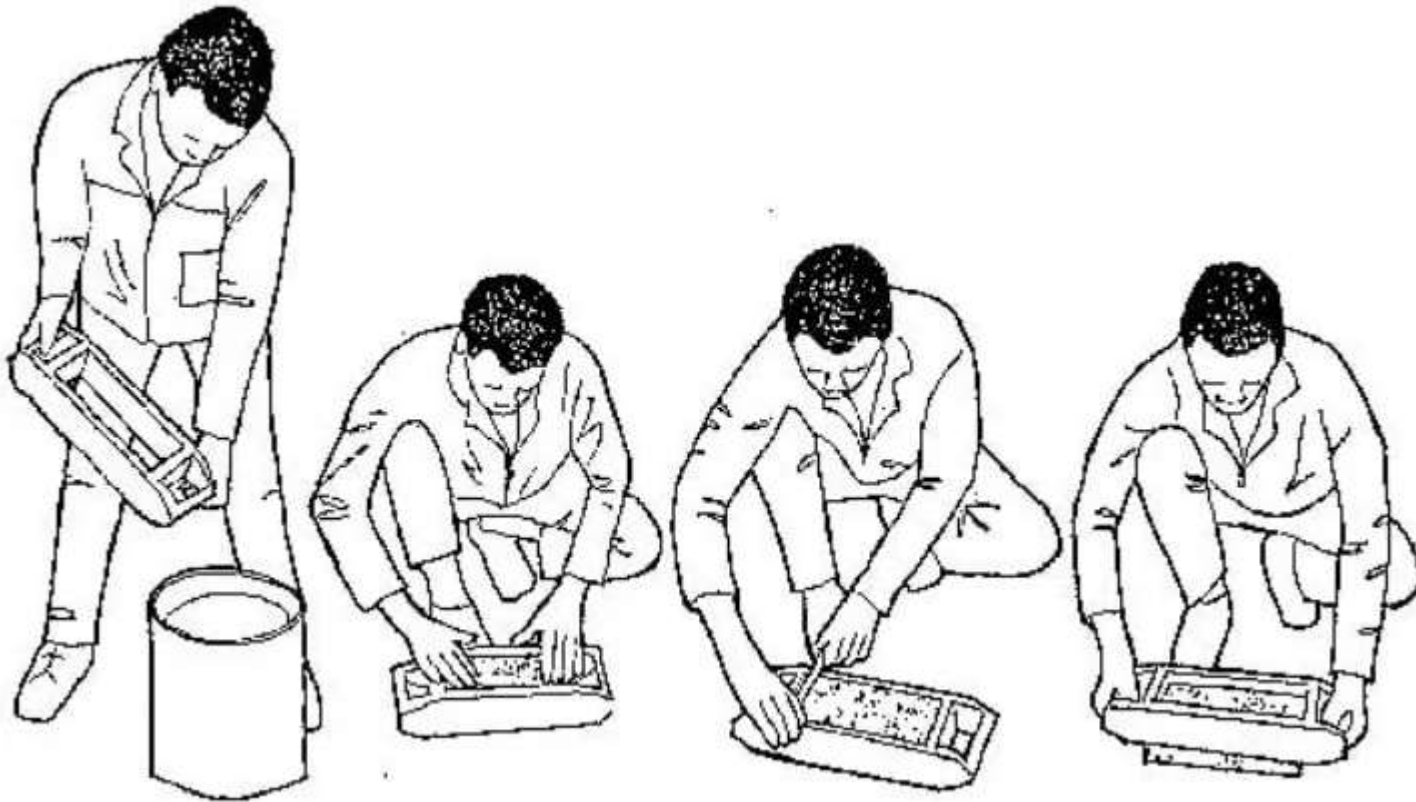
Molding of Clay

Dry clay machines

- Dry clay machines are more time saving machines.
- We can put the blended clay into these machines directly without tempering.
- Means tempering is also done in this machine by adding some water.
- When the required stiffness is obtained the clay is placed in mold and pressed hard and well-shaped bricks are delivered.
- These are called **pressed bricks** and these do not require drying they may directly sent to burning process.



Molding of Clay





Molding of Clay





Drying of Raw Bricks

- After molding process the bricks contain some amount of moisture in it. So, drying is to be done otherwise they may cracked while burning. The drying of raw bricks is done by natural process.
- The bricks are laid in stacks. A stack consists 8 to 10 stairs. The bricks in these stacks should be arranged in such a way that circulation of air in between the bricks is free.
- The period of drying may be 3 to 10 days. It also depends upon the weather conditions.
- The drying yards are also prepared on higher level than the normal ground for the prevention of bricks from rain water.
- In Some situations artificial drying is adopted under special dryers or hot gases.



Drying of Raw Bricks





Drying of Raw Bricks

The important facts to be remembered in connection with the drying of bricks are as follows:

(i) Artificial Drying:

- The bricks are generally dried by natural process.
- But when bricks are to be rapidly dried on a large scale, the artificial drying may be adopted.
- In such a case, the moulded bricks are allowed to pass through special dryers which are in the form of tunnels or hot channels or floors.
- Such dryers are heated with the help of special furnaces or by hot flue gases.
- The tunnel dryers are more economical than hot floor dryers and they may be either periodic or continuous.
- In the former case, the bricks are filled, dried and emptied in rotation.
- In the latter case, the loading of bricks is done at one end and they are taken out at the other end.
- The temperature is usually less than 120°C and the process of drying of bricks takes about 1 to 3 days depending upon the temperature maintained in the dryer, quality of clay product, etc.



Drying of Raw Bricks

(ii) Circulation of Air:

- The bricks in stacks should be arranged in such a way that sufficient air space is left between them for free circulation of air.

(iii) Drying Yard:

- For the drying purpose, special drying yards should be prepared.
- It should be slightly on a higher level and it is desirable to cover it with sand.
- Such an arrangement would prevent the accumulation of rain water.



Drying of Raw Bricks

(iv) Period for Drying:

- The time required by molded bricks to dry depends on prevailing weather conditions. Usually it takes about 3 to 10 days for bricks to become dry.



Burning of Bricks

- In the process of burning, the dried bricks are burned either in clamps (small scale) or kilns (large scale) up to certain degree temperature. In this stage, the bricks will gain hardness and strength so it is important stage in manufacturing of bricks.
- The temperature required for burning is about 1100°C . If they burnt beyond this limit they will be brittle and easy to break. If they burnt under this limit, they will not gain full strength and there is a chance to absorb moisture from the atmosphere.
- Hence burning should be done properly to meet the requirements of good brick.



Burning of Bricks



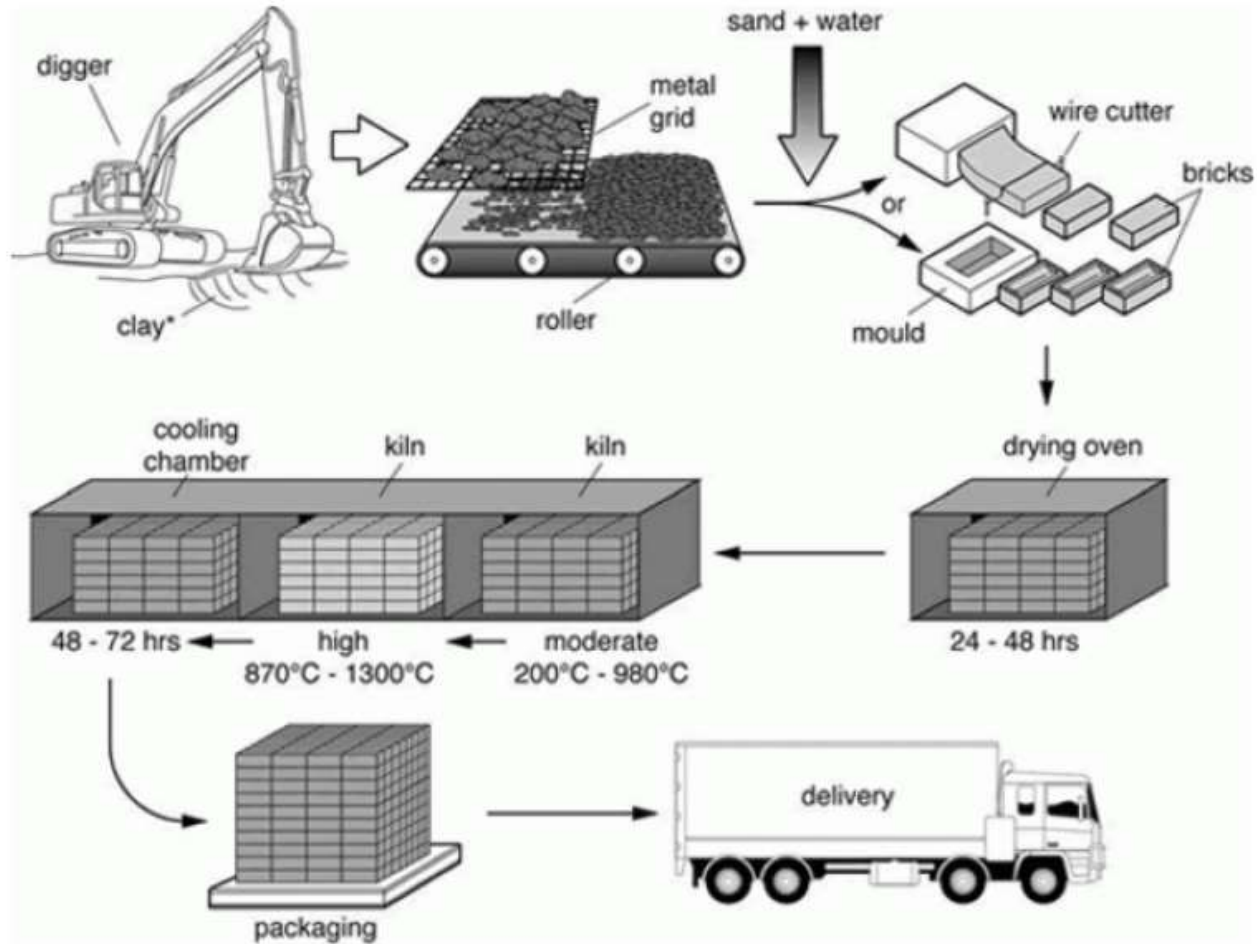


Burning of Bricks





Process of Brick Making



The process of brick making



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Unit 1 : Civil Engineering Materials and Surveying

Topic : Properties and Uses of Bricks



Properties of Bricks

❖ Strength

Clay bricks should have a minimum compressive strength of 9N/mm^2 for a building up to two storeys high, and 13N/mm^2 for anything higher.

❖ Colour

The most common brick colours are red. However, modern manufacturing methods have allowed for bricks of almost any colour to be produced. Good quality red bricks have a uniform colour throughout its body.

❖ Durability

Adequately manufactured bricks are incredibly durable, often lasting hundreds of years.



Properties of Bricks

➤ Absorption

Brick absorption value varies from product to product. Absorption refers to the quantity of water a brick can absorb, as a percentage of its total weight. Ordinary building bricks shouldn't have higher absorption than 25%.

➤ Size

Brick sizes vary across the world, with the UK standard brick size being 20cm x 9.5cm x 5.5cm or 19cm x 9cm x 9cm.

➤ Shape

Brick shapes should ideally be rectangular, with well-defined, sharp edges and an even surface. However, some brick manufacturers can produce specially-designed products, such as long format bricks.

➤ Bricks should be properly burnt, making a sharp metallic sound when struck together.



Uses of Bricks

1. Good quality bricks (1st and 2nd class) are used in the construction of buildings, tunnels, etc.
2. 3rd class and unburnt bricks are used for temporary structures.
3. 4th class bricks are used as aggregate for making concrete.
4. Bricks are also used for architectural purposes to give aesthetic appearance to the structure.



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Unit 1 : Civil Engineering Materials and Surveying

Topic : Tests on Bricks



Tests on Bricks

- Various types of tests on bricks are conducted to check the qualities of bricks for construction purposes.
- Tests on bricks are conducted at construction site as well as in laboratory.
- Bricks are oldest and important construction materials because of their durability, reliability, strength and low cost.
- To produce good quality of structure, good quality materials are required.
- To decide the quality of the materials some tests are to be conducted on bricks.



Tests on Bricks

Following tests are conducted on bricks to determine its suitability for construction work.

1. Absorption test
2. Crushing strength test
3. Hardness test
4. Shape and size
5. Color test
6. Soundness test
7. Structure of brick
8. Presence of soluble salts (Efflorescence Test)



Absorption Test

- Absorption Test is conducted on brick to find out the amount of moisture content absorbed by brick under extreme conditions.
- In this test, sample dry bricks are taken and weighed.
- After weighing, these bricks are placed in water with full immersing for a period of 24 hours.
- Then weigh the wet brick and note down its value.
- The difference between dry and wet brick weights will give the amount of water absorption.
- For a good quality brick the amount of water absorption should not exceed 20% of weight of dry brick.



Absorption Test

$$\text{Water absorption (\%)} = [(W2-W1) / W1] \times 100$$

Where

W1 = Dry Brick Weight (oven Dry Condition after 24 hours at temperature 110 to 150 °C)

W2 = Wet Brick Weight (After Immersion for 24 Hours)

S.N.	Brick Class	The maximum water absorption percentage
1.	First	20%
2.	Second	22%
3.	Third	25%
4.	Heavy-duty machine made bricks	5%



Absorption Test





Crushing Strength Test

- Crushing strength of bricks is determined by placing brick in compression testing machine.
- After placing the brick in compression testing machine, apply load on it until brick breaks.
- Note down the value of failure load and find out the crushing strength value of brick.
- Minimum crushing strength of brick is 3.50 N/mm^2 . if it is less than 3.50 N/mm^2 , then it is not useful for construction purpose.

$$\text{Compressive Strength} = \text{Maximum Load at Failure}(\text{N/mm}^2) / \text{Area of Specimen}(\text{mm}^2)$$



Crushing Strength Test

Compressive Strength of Different Types of Bricks

1. First-class brick – 105 kg/cm² or 10.3 N/mm²
2. 2nd class brick – 70 kg/cm² or 6.86 N/mm²
3. Common building brick – 35 kg/cm² or 3.43 N/mm²
4. Sundried brick – 15 to 25 kg/cm² or 1.47 to 2.45 N/mm²





Hardness Test

- A good brick should resist scratches against sharp things.
- So, for this test a sharp tool or finger nail is used to make scratch on brick.
- If there is no scratch impression on brick then it is said to be hard brick.



Shape and Size Test

- Shape and size of bricks are very important consideration.
- All bricks used for construction should be of same size.
- The shape of bricks should be purely rectangular with sharp edges.
- Standard brick size consists length x breadth x height as 19cm x 9cm x 9cm.
- To perform this test, select 20 bricks randomly from brick group and stack them along its length , breadth and height and compare.
- So, if all bricks similar size then they are qualified for construction work.



Shape and Size Test





Color Test

- The Colour test of bricks simply involves the visual examination of bricks for acceptable bright uniform colour throughout the body of the brick.





Soundness Test

- Soundness test of bricks shows the nature of bricks against sudden impact.
- In this test, 2 bricks are chosen randomly and struck with one another.
- Then sound produced should be clear bell ringing sound and brick should not break.
- Then it is said to be good brick.





Structure of Bricks

- To know the structure of brick, pick one brick randomly from the group and break it.
- Observe the inner portion of brick clearly.
- It should be free from lumps and homogeneous.





Efflorescence Test on Bricks

- A good quality brick should not contain any soluble salts in it.
- If soluble salts are there, then it will cause efflorescence on brick surfaces.
- To know the presence of soluble salts in a brick, placed it in a water bath for 24 hours and dry it in shade.
- After drying, observe the brick surface thoroughly. If there is any white or grey color deposits, then it contains soluble salts and not useful for construction.
- Efflorescence is a crystalline, salty deposit that occurs on the surfaces of bricks, concrete and other masonry products.
- It is white, sometimes white or an off white colour.
- In order for efflorescence to occur, there must be water present to dissolve and transport the salts to the brick surface.



Efflorescence Test on Bricks





Thank You!!