

**BUILDING MATERIALS AND
CONCRETE TECHNOLOGY
18CV34**

UNIT I

- **INTRODUCTION**

Physical, chemical and engineering properties of building materials.
Application of building materials.

- **Bricks**

Types of bricks, manufacturing process of bricks, properties of bricks,
Standard requirements and grades of bricks as per BIS.

- **Rocks and Stones**

Classification of rocks, Rock products, Characteristics of stones –
Structure, texture, strength, gravity, porosity, absorption, hardness,
durability, weight. Standard requirement of building stone.

- **Timber**

Types of timber, Uses and application of timber, Defects in timber
and wood, Seasoning, Wood products with specific uses.

Self-Learning topics: Important stones used in construction with its suitability.

BUILDING MATERIALS

DEFINITION

Building material is any material used for construction purpose such as materials for house building.

Wood, cement, aggregates, metals, bricks, concrete, clay are the most common type of building material used in construction.

The choice of these are based on their cost effectiveness for building projects.

PROPERTIES:

1. Physical
2. Chemical
3. Engineering

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PHYSICAL PROPERTIES

1. Density
2. Bulk Density
3. Density Index
4. Specific weight
5. Specific gravity
6. Porosity
7. Durability
8. Permeability
9. Water Absorption
10. Resistance to fire and frost
11. Thermal conductivity

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Density:

It is the mass of a substance occupied per unit volume. Its unit is kg/m^3 .

Density of some common building materials are listed below

Steel = 7800

Brick = 2600

Granite = 2800

Wood = 1500

Bulk Density:

It is the mass of a substance occupied per unit volume in its natural state.

Density Index:

The ratio of bulk density to its density.

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Specific Weight:

Specific weight is defined as the weight occupied per unit volume.

$$w = \rho \times g$$

ρ = Density of the substance in kg/m^3

g = acceleration due gravity in m/s^2

Specific Gravity:

Specific gravity is defined as the ratio of the density of given substance to the density of water at 4°C

Specific gravity is a dimensionless quantity. Specific gravity is denoted by the symbol “G”.

$G = \text{Density of substance} / \text{Density of water}$

Density of water is 1 g/cc or 1 KN/m^3

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Porosity:

Porosity is defined as the ratio of volume of voids to volume of solids.

The notation of porosity is 'n'

$$n = V_v / V$$

V_v = Volume of voids

V = Total volume

Durability:

The property of a material to resist the combined effect of atmosphere and other factors.

Permeability:

Property of a material that lets fluids (such as **water** or **water** vapor) to diffuse through it to another medium without being chemically or physically affected.

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Water Absorption:

The ability of a material to absorb and retain water.

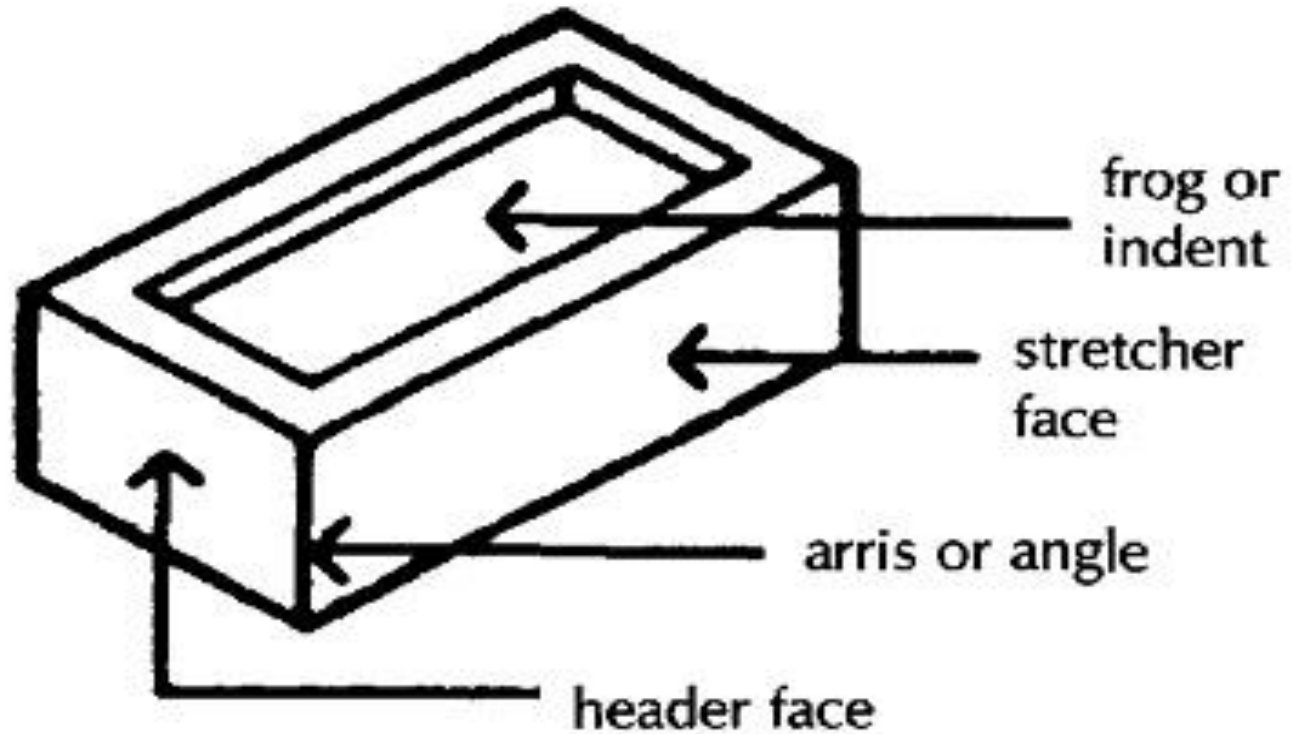
Resistance to Fire and Frost:

The ability of a material to resist the action of fire repeated freezing and thawing of frost.

Thermal conductivity:

A measure of the ability of a material to transfer heat. The **thermal conductivity** is the heat energy transferred per unit time and per unit surface area, divided by the temperature difference.

Details of a Brick



TYPES OF BRICKS

- **Traditional Bricks**

- Not standardized.
- Dimensions vary - length 20-25cm, width 10-13cm, thickness 5-7.5cm.
- Commonly adopted size 23cm*11.4cm*7.6cm

- **Modular Bricks**

- Confirm to Bureau of Indian Standard Institution.
- Size of the brick- 19cm*9cm*9cm.
- Nominal size – 20cm*10cm*10cm. Includes mortar thickness.

CLASSES OF BRICKS

1. First Class Bricks

- ✓ Strictly confirm to IS standards.
- ✓ 10 layers of brick laid in mortar forms a height of 1m.
- ✓ Uniform colour, well burnt, hard ringing sound emits when two bricks are struck together.
- ✓ Have straight edges, free from cracks, nodules of lime.
- ✓ When immersed in water for one hour do not absorb water more than $\frac{1}{6}^{\text{th}}$ of their weight.
- ✓ No signs of Effloescence.

2. Second Class Bricks

- ✓ Slightly irregular in shape, colour.
- ✓ When immersed in water for one hour do not absorb water more than $1/4^{\text{th}}$ of their weight.

3. Third Class Bricks

- ✓ Irregular in size, shape and finish.
- ✓ Not fully burnt, hence slight yellowish in colour.
- ✓ Low crushing strength.

PROPERTIES OF BRICKS

- The bricks should be table mould, well burnt in kilns, copper coloured, free from cracks and with sharp and square edges. The colour should be uniform and bright.
- The bright bricks should be uniform in shape and should be of standard size.
- The bricks should give clear metallic ringing sound when struck with each other
- The bricks when broken or fractured should show a bright homogeneous and uniform compact structure free from voids.

PROPERTIES OF BRICKS

- The bricks should not absorb water more than 20% by weight for first class bricks and 22% by weight for second-class bricks, when soaked in cold water for a period of 24 hours.
- The bricks should be sufficiently hard. No impression should be left on brick surface, when it is scratched with fingernail.
- The bricks should not break into pieces when dropped flat on hard ground from a height of about one metre.

QUALITIES OF BRICK

- Aesthetic Appearance: Shape
- Durability: Strength and lasting power
- Resistance to Rain Penetration
- Compressive Strength
- Fire Resistance
- Sound Insulation
- Economy
- Versatility in Application
- Low maintenance Requirement

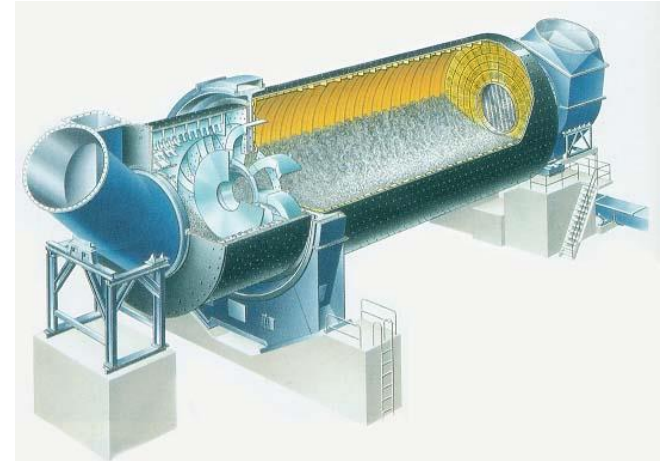
MANUFACTURING OF BRICKS

Considerations

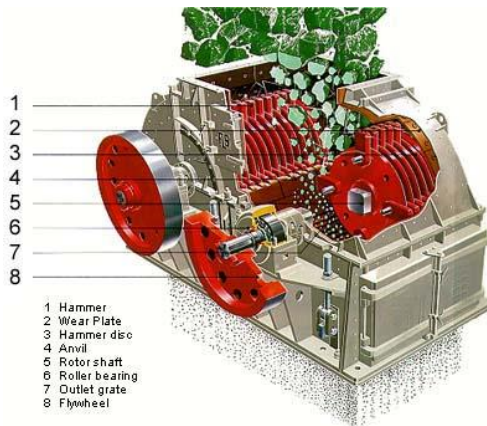
- Material conveyance should be easy.
- Situated on plain ground.
- Raw materials should be easily available.
- Proper Facilities

MANUFACTURING OF BRICKS

- Manufacture - 4 stages
 - Material preparation
 - Manufacturing
 - drying
 - Firing
- **Preparation:** material (clay) washed and grinding (fineness)



Sample of grinding machine for clay

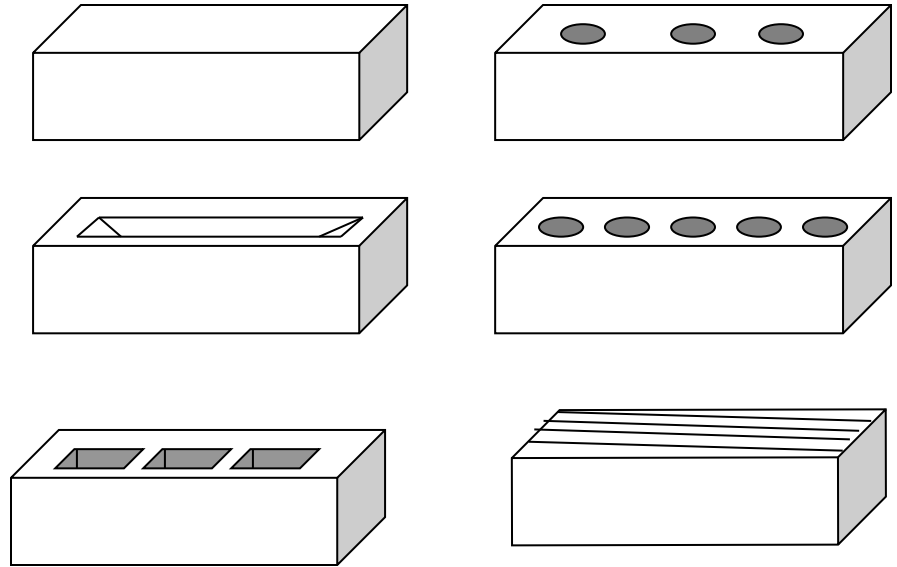


Sample of crushing machine

MANUFACTURING OF BRICKS

- Clay will be grinded with 15% water. The clay will be pushed through the mould base on the shape. After that, Clay will be cut to get a standard size of brick using wire.
- Sometimes, bricks will be produced using big mould that clay will be pressed using hydraulic machine (This method, clay will grind 10% of water) or without hydraulic press (with 30% of water)

- After bricks in form, indentation or perforation to the bricks.
- **Drying** : Wet unit bricks will be drying in space or room with control temperature to make sure the bricks are complete dry.

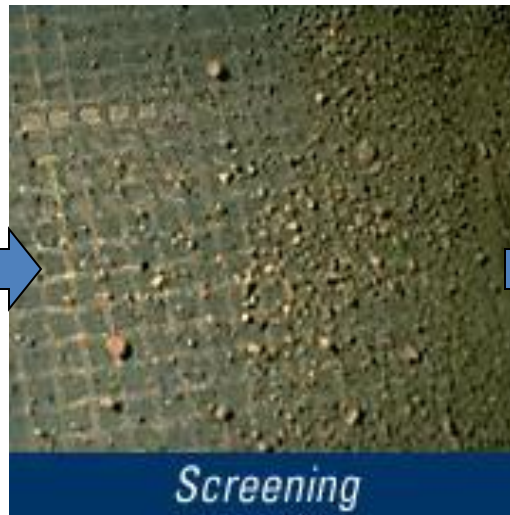


Brick compile before bringing to the kiln



- **Firing** : Dry bricks, will be compiled in kiln to firing process with 600°C (temperature). This is to burn the carbon and sulfur that have left over. After that, temperature is increased to 900°C to get a vitrification process.
- Normally, vitrification process occurs around 800°C .
- Bricks become hard/strong after vitrification process.





MATERIAL PREPARATION



Inside die head



Core hole die

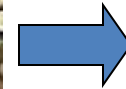
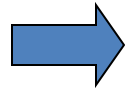
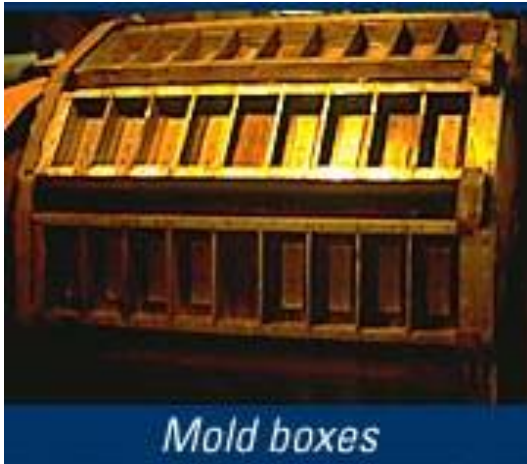


Extruded column



Cutting

Manufacturing



Manufacturing



Setting



Firing Process



Packaging