

Construction Materials For Food Science and Engineering

Construction Material: Brick

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Brick

Brick: A brick is an artificial kind of stone made of clay whose chief characteristics are **plasticity when wet and stone like hardness after being heated to high temperature.**

Factors Affecting the Quality of Bricks:

- Chemical properties of the clay used.
- Preparation of clay.
- Process of drying.
- Different degrees of burning.

Constituents of Brick clay and their Functions

Sl	Constituent	%	Functions
1	Silica (SiO ₂)	55	<ol style="list-style-type: none"> 1. Prevents cracking, shrinking and warping 2. But too much of sand makes brick brittle and weak
2	Alumina (aluminum oxide, Al ₂ O ₃)	30	<ol style="list-style-type: none"> 1. Imparts plasticity to clay and helps moulding and also imparts density 2. But too much makes brick crack and warp during drying bricks become very hard when heated.
3	Iron oxide (Fe ₂ O ₃):	8	<ol style="list-style-type: none"> 1. Enhances the impermeable and durable quality of bricks. 2. It gives light yellow to red colour to bricks.
4	Magnesia (MgO)	5	<ol style="list-style-type: none"> 1. It decreases shrinkage and gives yellow tint.
5	Lime (Calcium Oxide, CaO)	1	<ol style="list-style-type: none"> 1. It reduces shrinkage of bricks during drying and enables the silica to melt in burning and thus binds the particles of brick together 2. In excess, however, it will cause the brick to fuse too readily and the shape will be lost.
6	Organic matters	1	<ol style="list-style-type: none"> 1. A small quantity of organic matter will assist burning bricks. 2. However, excess is bad because if it is completely burnt, the bricks will be porous,

Harmful Constituents of Brick Clay

- 1. Iron Pyrites (sulphide of iron):** Presence of iron pyrites causes **crystallization and disintegration** of bricks on burning.
- 2. Alkalies:** They are mainly the **chlorides and sulfates of calcium, magnesium, sodium and potassium**. They produce a **dark greenish colour** on the surface of bricks on drying. They cause the bricks to **fuse, twist and warp during burning**. Alkalies in bricks absorb moisture from surrounding and on drying cause efflorescence.
- 3. Stone Particles:** Small particles of stones **do not allow the clay to be mixed thoroughly and uniformly**. These are **harmful to the uniformity to the brick textures**. These make bricks **porous and weak**.
- 4. Vegetation and Organic Matter:** They make the bricks **porous and weak** because vegetation and organic matter get burnt during the burning leaving small pores in them.
- 5. Lime:** Lime if present in **excess** causes the brick to **fuse too rapidly and the shape is lost**. Lime in the form of **limestone and kankar nodules** is very harmful and cause serious troubles to bricks. Because due to high heating, limestone (CaCO_3) is converted into lime (CaO) and carbon dioxide (CO_2). On contact with water, lime gets **hydrated and swells** and causes the bricks to **split and crumble** to pieces.

Manufacturing of Bricks

In manufacturing of bricks the following steps are followed:

1. Selection of Brick Clay:
2. Preparation of Brick Clay:
3. Brick Moulding:
4. Brick Drying:
5. Brick Burning:

Brick Burning Methods:

- Clamp or Pazawah Burning:
- Kiln Burning:
 - Hoffman's Kiln:
 - Trench or Tunnel Kiln:

The average output of tunnel kiln is as follows:

- | | |
|---------------------|-----|
| 1. 1st class bricks | 60% |
| 2. 2nd class bricks | 15% |
| 3. 3rd class bricks | 10% |
| 4. Picked Jhama | 5% |
| 5. Jhama bats | 5% |
| 6. Bricks bats | 5% |

Characteristics of Good Bricks

1. Bricks should be **uniform in colour, size and shape**.
2. They should be **sound and compact**.
3. They should be **free from cracks and other flaws such as air bubbles, stone nodules etc.**
4. They should absorb more than **1/6 of their own weight** of water when immersed in water for 24 hours (**15 to 20% dry wt.**).
5. The compressive strength of bricks should be in the range **of 5,000 to 8,000 psi**.
6. The percentage of soluble salts (sulphates of calcium, magnesium, sodium and potassium) should not exceed **2.5% in burnt bricks**, because the presence of excess soluble salts causes efflorescence.
7. They should be neither **overburnt or underburnt**.
8. The weight should be generally **6 lbs per brick** and the **weight per cft should not be less than 125 lbs**.
9. They should have low thermal conductivity as it is desirable that the buildings built of them should be cool in summer and warm in winter.
10. They should be **non-inflammable and incombustible**.
11. Bricks should **not change in volume when wetted**.

Size of Bricks and Field Test of Bricks

Size of Bricks:

In Bangladesh, according to PWD specification, each brick should measure **9.1/2 in. x 4.1/2 in. x 2.3/4 in.** This is the standard size of brick and is most economical. Because when bricks are put in any construction with mortar the size becomes 10 in. x 5 in. x 3 in. (approximately). As the size of the wall constructed in our country are 5", 10", 15", 20"30", this size of bricks can be used safely without breaking.

Field Test of Bricks:

The following are the tests that are generally performed in the field to determine the quality of good bricks:

1. Take a brick and try to make **mark in the surface by nail**. If you can make it, it not a good brick, if not it is very hard and compact.
2. Take a brick and **strike it with a hammer**. If it gives clear **ringing or metallic sound**, it is a good brick, if not, it is a bad brick.
3. Take two bricks and **form a tee (T)** and drop from a height of **6 ft** on a more or less **solid surface**. If they break, they are not good bricks. If they remain unbroken, they are good bricks.

Classification of Bricks

Classification of bricks according to P.W.D. in Bangladesh.

1. First Class Bricks:

- a. They should be of **uniform size and color, thoroughly and evenly burnt.**
- b. They should be **well shaped** with **even surfaces** and without **cracks, rain spots** or **flows** of any kind and must have **proper strength.**

2. Second Class Bricks: These bricks must possess the **hardness and colour** of first class bricks but are **slightly irregular in shape, size or rough on the surface.**

3. Third Class Bricks: These are bricks which are **not sufficiently well-burnt** and of **uniform shape and size** and are used in unimportant construction.

4. Picked Jhama Bricks: These bricks are uniformly vitrified throughout but must be of good shape, heavy and of selected quality. **They must not be spongy.**

5. Jhama Bricks: These are well-burnt bricks but not quite so well shaped as picked jhama bricks. They must not be spongy and must be free from cinders and projecting lumps.

Classification of Bats

Bats: Bats are the broken bricks.

Classification

- 1. First Class Bats:** These are broken bricks of the same quality as first and second class bricks.
- 2. Second class Bats:** These are broken bricks of the same quality as third class bricks.
- 3. Jhama Bats:** These are broken bricks of the classes picked jhama and jhama bricks.

Brick Works

Brick Works

The following are the different types of brick works:

- **First Class Brick-work:** This consists of first class bricks in lime or cement mortar. All the material required should be of first class quality.
- **Second Class Brick-work:** This consists of second class bricks laid in lime or cement mortar.
- **Third Class Brick-work:** This consists of third class bricks in mud mortar.

Some Standard Measurement

- For 100 cft of brickworks require 1200 nos. of bricks and 45 cft of mortar.
- 100 cft of khoa for concrete require 830 nos. of bricks.

Thanks