Building Materials II

Lecture 1

Bricks

Everyone ones what is a brick, it is one of the oldest material that has been used for building constructions. It is very popular and it is also one of the leading construction materials. What make the brick very popular in the construction is these are very cheap, durable and very easy to work with these three factors makes the brick most popular building material. Now traditionally the bricks where sun dried i.e., they are made up mud and dried out in the sun.

Then fired bricks come and inexistence people realized that when they fired the brick they had better resistance condition. This made them more reliable brick for use in permanent building constructions.

What is Brick?

Brick is basically a rectangular piece of object, cuboid which is usually in a size which can be handled with one hand. The most common material for making brick is burned clay and also there are other materials such as mixture of sand and lime or Portland cement etc. the clay bricks are the most popular and application of brick we have very varied applications.

Sizes of brick:

Usually the size of the brick depends on the contact or the locality where the brick is being used. There are many sizes available in market. Now there are two sizes of brick one is the actual size and the other one is nominal size.

Actual size:

Let us take the brick length as A and the breadth as B and the depth of the brick as C. When it comes to the actual size the size of the brick will be what is A,B,C. In

actual size the length of the brick is two into the width of brick and height of brick is equal to the width of brick.

Nominal Size:

When it comes to the nominal size the size of the brick will be Actual size plus the mortar thickness that is the size of A plus mortar thickness and the size of B plus mortar thickness and the size of C plus the mortar thickness. In nominal size the length of brick is two into the width of brick plus the mortar thickness and the width is equal to the height of the brick.

Standard Bricks:

This bricks are called the fired bricks and most commonly used bricks. In this bricks the actual size will be 2.15 mm x 102.5 mm x 65 mm(8.5" x 4" X 2.5"). And when it comes to the nominal size the size of the brick will be as 22 5 mm x 112.5 mm x 75 mm(9" x 4.5" X 3").

Modular bricks:

These bricks are recommended by BIS (Bureau of Indian Standards). They recommend a modular size of bricks. In this the actual size is 190mm x 90mm x 90mm. And the nominal size is 200mm x 100mm x 100mm.

Weight of the Brick:

It is seen that one meter cube of brick is about 1800 kilograms. So from the one meter cube of a brick we can get 500 to 600 bricks that give the average weight of the brick as about 3 to 3.5 kilograms.

Parts of Bricks:

When the brick laid in bed as shown in the picture the parts are divided as the head, stretcher, and the Frog as shown in the picture. When the brick is laid in the bed the longer portion is called the stretcher and the shorter is called header. When it is laid on edge then the longer portion becomes shiner and the shorter become rowlock. When it is laid to stand the larger portion becomes the sailor

and the smaller portion becomes the soldier. Here is an example given for that in this image you can see some of the brick.

What is Frog?

Frog is an indent that is given in1 to 2 cm deep on the top of a brick. It is provided for about 9cm high brick. Now the size of frog should be 10 x 4 x 1 cm. The purpose of providing the frog is to provide a key so that the bricks can hold tightly to each other.

The frog are created as when we mode the brick a wooden piece is kept in the middle so that after moulding we can remove the wooden piece which creates the frog. There are two things to be remembered for creating this frog they are the brick laying in such a way that the frog should be on top and also the next thing is the frog is not provided in 4 cm high bricks and extruded bricks.

Here why should the frog portion should be on the top means we see an example see the picture the orange portion shows how the mortar is sitting on the frog. When we keep the frog at bottom you can see a space which the mortar is not filling up there. This is the reason why the frog is kept on the top of the brick.

Composition of Brick

We will see what will be the composition of good brick at, now will be looking at clay brick. So will see what will be the composition of good clay brick. Here the major component is Silica. Silica makes about 50-60% of the brick earth. Here silica can be formed in free form or mixed with something else. Why we use silica means it avoid cracking, shrinking and warping of raw bricks. And also silica help in giving a uniform shape, it increase the durability of the brick. If you use the silica in excess it will destroy the cohesion. When you burnt the brick silica melts and make the brick more compact.

The next major component of the brick is Alumina. It makes about 20-30% of the brick. It helps in the plasticity moulding of the earth. If you use the alumina in excess it will shrink and warp during drying. The next component is the Lime it makes about 5-15% of the brick. Again lime also helps in preventing the shrinkage

and helps in binding the silica. If you use the lime in excess it makes the brick to lose its shape.

When you add the lime to the brick it should be powdered form. The next component is Iron oxide it is used in about 5-10%. Iron oxide is the component that gives the cooper reddish color to the brick. If you use it in excess it will become darer to black and if you use it lesser the brick become yellowish. Finally we use magnesia which is use very less amount of 1%. It is used to reduce the shrinkage. If you use the magnesia excess it will lead to decay of the brick.

Manufacturing Process

There are four major steps in the manufacturing of bricks. The first one is preparing the clay, second is moulding and the third one is drying and the fourth one is burning the brick.

Preparing the clay:

There are several steps to prepare the clay you cannot just dig the clay from the earth and use it for manufacturing the bricks. You first go throw un-soiling.

Un-soiling:

Un-soiling is the top layer of the soil of about 60cm to 1m. This top most layer contains lot of organic compounds etc. So this has to be removed to get the more clear form of clay.

Digging:

This can be manually done or now-a-days lot of machinery is used to dig out the clay. When the clays dig out it is spread on the leveled ground or it should be put in heaps that heaps should be about 60 cm.

Cleaning:

Even we get the clay from the bottom layer it may have some impurities such as plant roots and vegetable matter and all. So this clay sould be washed and screened.

Weathering:

In this step what happens is basically we take the clay out and it is exposed to atmosphere. During the process of weathering the clay makes more soft and mellowing. Because of the weathering stage the brick which we obtain in the final stage got a better resistance to atmospheric weathering conditions. The period of weathering can depend upon the location where it can be done. It can be from a week to 4-5 months.

Blending:

Blending is basically to made loose and certain ingredients like iron oxide, magnesia etc. are added on top of it and mixed to get a harmonious mixer.

Tempering:

In the process of tempering the clay is brought to a proper degree of hardness and it is made fit for the next operation of moulding. There are two types of tempering such as manual tempering and mechanical tempering.

Manual tempering:

The water in required quantity is added to clay and the whole mass is kneaded or pressed under the feet of men or cattle. The tempering should be done exhaustively to obtain homogeneous mass of clay of uniform character.

Mechanical tempering:

The most commonly used for mechanical tempering is Pug mill. It major part of pug mill consists of a conical iron tube. The mill is sunk 60 cm into the earth. A vertical shaft with a number of horizontal arms fitted with knives is provided in the center of the tube. This central shaft is rotated with the help of bullocks yoked at the end of long arms. However steam, diesel or electric power may be used for this purpose. Blended earth along with required water is fed into the pug mill from the top. The knives cut through the clay and break all the clods or lump-clays when the shaft rotates. The thoroughly pugged clay is then taken out

from opening provided in the side near the bottom. The yield from a pug mill is about 1500 bricks.

Moulding:

In this process we have two different types of moulding such as hand moulding and machine moulding. Again in hand moulding we have ground moulding and table moulding. Then in machine mouldingthere are plastic clay machine and dry clay machine.

Hand moulding:

In hand moulding the bricks are molded by hand that is manually it is adopted where manpower is cheap and is readily available for the manufacturing process of bricks on a small scale.

The molds are rectangular boxes which are open at top and bottom. They may be of wood or steel. A typical wooden mould should be prepared from well-seasoned wood. The longer sides are kept slightly projecting to serve as handles. The strips of brass or steel are sometimes fixed on the wooden moulds to make them more durable.

Ground moulded bricks:

The ground is first made level and fine sand is sprinkled over it. The mould is dipped in water and placed over the ground. The lump of tempered clay is taken and it is dashed in the mould. The clay is pressed or forced in the mould in such a way to fills all the corners of mould. The extra or surplus clay is removed either by wooden strike or metal strike or frame with wire. A strike is a piece of wood or metal with a sharp edge. It is to be dipped in water every time. The mould is then lifted up and raw brick is left on the ground. The mould is dipped in water and it is placed just near the previous brick to prepare another brick. The process is repeated till the ground is covered with raw bricks.

The lower faces of ground moulded bricks are rough and it is not possible to place frog on such bricks. The ground moulded bricks of better quality and with frogs on their surface are made by using a pair of pallet boards and a wooden block.