Building Materials II

Lecture 2

Moulding

There are four main steps in manufacturing in preparing the clay: Moulding, Drying and Burning. Preparing the clay, we had unsoiling, digging, weathering, blending and tempering. At the end of the preparation of clay, we have a well blended clay in hand. Now with this clay, we will go next step of 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 moulding there 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. Here you can see the name of the company on the top of the bricks this also function as the frog. So now-a-days this is what the brick manufacturing companies are doing they also imprint the name of the company into the frog.

Table-Moulding bricks:

Table moulding is also a form of the ground moulding. It is very similar to the hand moulding but it is done on the top of the table of size about 2m x 1m. The clay, mould, water pots, stock board, strikes and pallet boards are placed on this table.

The brick are moulded on the table and sent for the further process of drying. However the efficiency of moulding decreases gradually because of standing at the same place for long duration and the cost of brick moulding also increase when table moulding is adopted.

Machine moulding:

Machine moulding is as the name says the moulding is done using machine. This machine moulding proves to be economical when bricks in huge quantity are to be manufactured at the same spot in a short time. It is also for moulding hard and strong clay. These machines are broadly classified in two categories. The first thing is plastic clay machines.

Plastic clay machines:

In this machine only the moulding is done by the machine. The well-tempered clay is feed into the machine and the machine then sends out the strip of moulded clay with the desired height and width. Such machines are contains a rectangular opening of size equal to length and width of a brick.

The pugged clay is placed in the machine and as it comes out through the opening, it is cut into strips by wires fixed in frames. The arrangement is made in such a way that strips of thickness equal to that of the brick are obtained. As the bricks are cut by wire they are also known as the wire cut bricks.

Dry Clay machines:

In these machines the strong clay is first converted into powder form. A small quantity of water is then added to form a stiff plastic paste. Such paste is placed in mould and pressed by machine to form hard and well-shaped bricks.

These bricks are known as the pressed bricks and they do not practically required drying. They can be sent directly for the process of burning. The wire cut and pressed bricks have regular shape, sharp edges and corners. They have smooth external surfaces. They are heavier and stronger that ordinary and moulded bricks. They carry distinct frogs and exhibit uniform dense texture.

Drying:

Drying is basically that this moulded bricks are left into the air to dry.

Why drying is required?

Here why drying is required means the damp bricks if burnt they are likely to be cracked and distorted. So the moulded bricks are dried before they are taken for the next operation of burning.

Drying stack

For drying the bricks are laid longitudinally in stacks of width equal to two bricks. A stack consists of eight or ten tiers. The bricks are laid along and across the stack in alternate layers. All bricks are placed on edge.

The drying of brick is by following means,

- **Artificial drying** – the artificial means by tunnels usually 120 degree Celsius for about 1 to 3 days.
- **Circulation of air** – stacks are arranged in such a way that sufficient air space is left between them free circulation of air.
- **Drying Yard** – special yards to be prepared slightly higher level prevent the accumulation of rain water.
- **Period of drying** – Usually the period of drying is for 3 to 10 days to bricks to become completely dry.
- **Screens** – screens are necessary may be provided to avoid direct exposure to wind or sun.

Burning

This is the most important stage because here the very important operations in the manufacturing of bricks to impart such as hardness, strength and makes dense and durable. Burning of bricks is done either in clamps or in kilns. Clamps are the most initial way of burning the clay before the kilns were invented.

Burning in Clamps:

They are used in brick-making on a large scale and continuous supply of bricks has to be kept up. A rectangular clamp which is very commonly used in south India is rectangular clamp give better result than circular clamps.

At first the site for the clamp is carefully leveled and consolidated. A trench is cut round the clamp to catch any rain water which may otherwise get into flues.

Burning in Kilns

Now-a-days burning in Kilns is most widely used method to burn bricks to get a large quantity of bricks. A kiln is a large oven which is used to burn bricks. There are two types of kilns they are Intermittent and Continuous. Under the

continuous there are three types such as Bull's trench kiln, Hoffman's kiln and tunnel kiln.

Intermittent Kilns:

The Intermittent kilns which means that they are to load, fired, cool and unload the bricks. Here you can see the plan of the intermittent kilns, it is majorly rectangular and a very simple structure. You have the outer wall and then the alternate rows of bricks and flues.

The ware to be fired is placed into the kiln. The kiln is closed and the internal temperature increased according to a schedule. After the firing is completed both the kiln and the ware are cooled. Then the ware is removed, the kiln is cleaned and the next cycle begins.

Traditionally intermittent kilns were nothing more than a trench drug in the ground filled with a fuel source and unfired pots. Intermittent kiln may be either rectangular circular or oval shaped. Intermittent kiln is used only when the demand for the brick is not high. If the demand for the bricks is large we need to use the continuous kilns. In Continuous first will see Bull's trench kiln.

Bull's trench kiln:

Bull's trench kilns are rectangular, circular or oval in shape. For the easy work like loading and unloading oval shapes are used. This trench is excavated in ground so it is partially underground and partially above the ground. Openings in the outer walls and there is inner wall. And then you have flue holes.

The kiln is separated into various sections such as Iron plates this iron plates are called dampers which divides the kilns in suitable sections. It is mostly used in India and it requires about one day for burn the bricks.

Here will see how the burning is processed you see the chimney over there in the picture that is to be burned. First it is to be inserted any of the section and to the flue holes. These bull's trench kilns provide two chimneys which are movable. There are two things to control the heat one is they insert or remove the flue to

control and the second thing is they move the chimney to the suitable section of the kiln.

Hoffman's Kiln:

The next type of continuous is Hoffman's kiln unlike the bull's trench kiln this is completely placed in the ground. So it is also known as flame kiln and it is circular or rectangular in plan. The mostly used is circular or oval kiln and this is also divided into several compartments and chambers. The permanent roof is provided and this kiln can even function during the season. Hoffman's kilns can also burn continuously.

How this chimney works is there are several compartments and the flues are inserted from the top. In the compartment they brick is burnt. Once the brick is burnt it is led to dry. At the same time the next compartment is burnt in the next day. For example today the first compartment is burnt and the brick is filled in the next compartment and burnt the next day.

The main difference between the Hoffman's kiln and the bull's trench kill is the way the fuel is inserted or where the flue holes are provided. The bull's trench kilns not have the permanent roof while the Hoffman's kiln has the permanent kiln. In Hoffman's kiln the flue is provided in the top and in the bull's trench kiln the flue is provided in the sides.

Tunnel Kiln:

This type of kiln is in the form of tunnel which may be straight, circular or oval in the plan. Raw bricks are placed in trolleys which are then moved from one end to the other end of tunnel. Raw bricks get dried and pre-heated as they approach zone of fire.

In zone of fire bricks are burnt to required degree and they are then pushed forward for cooling. When bricks are sufficient cooled they are unloaded. The kiln proves to be economical when the bricks are manufactured on a large scale. As temperature is under control uniform bricks of better quality are produced.

Summary:

So summarizing the manufacturing of bricks the clay is dig out of the soil and then it is cleaned then it is moulded by hand or by machine. If its machine it is wire cut. And then the process of drying which can be naturally dried or artificially dried. After drying comes the burning in the kiln there is continuous kilns and intermittent kilns. Then the bricks are sent for packaging and delivery.

Questions:

1. Why can't we use the top layer of soil for the brick earth?
2. What are the different methods of tempering? Explain the importance of tempering.
3. Do you know any other types of kilns used to burn bricks?