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Constructional Technology

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Normal and Concrete Tiles Manufacturing

Introduction:

A tile is a manufactured piece of hard-wearing material such **as ceramic, stone, metal, baked clay, or even glass, generally used for covering roofs, floors, walls.** Tiles are often used to form wall and floor coverings and can range from simple square tiles to complex or mosaics. Tiles are most often made of ceramic, typically glazed for internal uses and unglazed for roofing, but other materials are also commonly used, such as glass, cork, concrete and other composite materials, and stone. Tiling stone is typically marble, granite, or slate. Thinner tiles can be used on walls than on floors, which require more durable surfaces that will resist impacts.

Characteristics of a Good Tile:

Following are the characteristics of a good tile:

(1) It should be free from any cracks, flaws, or bends.
(2) It should be regular in shape and size.
(3) It should be hard, and durable.
(4) It should be well burnt.
(5) It should give a clear ringing sound when struck with a hand or with one another or with a light hammer.
(6) It should fit in properly when placed in position.
(7) It should give an even and compact structure when seen from any side.
(8) It should possess uniform color.

First: Normal (Ordinary) Tiles:

Types of Common (Normal, Ordinary) Tiles:

Depending upon the use to which the tiles are put, the following are their different types:

(1) Drain tiles
(2) Floor or paving tiles
(3) Roof tiles.

(1) Drain Tiles:

These tiles are prepared in such a way that they retain porous texture after burning. Hence, when such tiles are laid in the waterlogged areas, they allow subsoil water to pass through their construction body. These drains may be circular, semi circular, or segmental. They are also used to convey irrigation water. Such drain tiles are rarely adopted in modern time

(2) Floor or Paving Tiles:

The floor or paving tiles may be square or hexagonal in shape. These are flat tiles and their thickness varies from 12 mm to 50 mm. The size of square tiles varies from 150 mm to 300 mm. The floor tiles should be hard and compact so that they can resist wear and tear in a better way. The floor tiles of the thin sections can be adapted for the ceiling also. To prepare colored floor tiles, the coloring substance is added in the clay at the time of its preparation. The floor tiles of comparatively less strength can be adopted for fixing on walls.

(3) Roof Tiles:

These tiles are used to serve as a cover for the pitched roof. The various types of roof tiles are available in the market.

***Manufacturing Process of Common (Normal, Ordinary) Tiles:**

Following four distinct operations are involved in the general process of manufacturing the common tiles:

(1) Preparation of clay, (2) Molding, (3) Drying, (4) Burning.

(1) Preparation of Clay:

The selected clay is taken and it is made free from any impurity such as grit, pebbles, etc. Such clay is then pressed and converted into fine powder in pug mills. For tiles of superior quality, a large quantity of pure water is added to the powdered clay and it is well mixed in a tank.

The mixture is then allowed to settle quietly. The coarse, heavy particles settle at the bottom of the tank. The fine particles are taken into other tanks and the water is then allowed to dry off. The fine clay left after such a process is used for the manufacture of tiles.

To make the tiles hard and impervious, a mixture of ground glass and pottery-ware may be added in the required quantity to the clay tiles.

(2) Molding:

The clay is placed in molds which represent the pattern or shape in which the tile is to be formed. The molding may be done either with the help of wooden molds or mechanical means. The wooden molds should be prepared from well-seasoned timber. The clay is pressed into such molds and tiles are ready for drying when the clay is taken out of the molds. Care should be taken to preserve the shape of tiles during the removal of molds. The tiles which do not have a uniform section throughout their length are molded with the help of wooden molds.

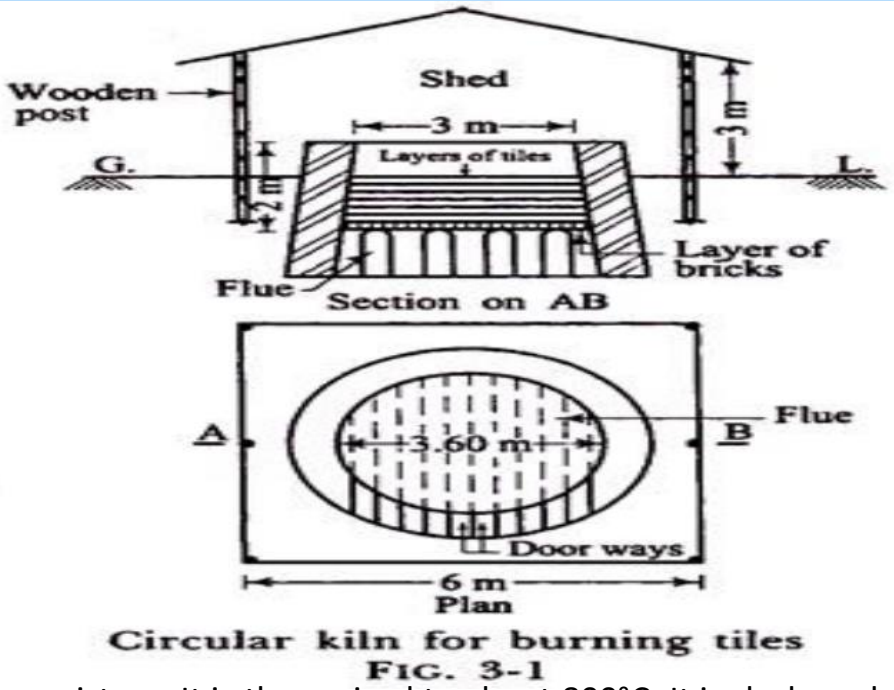
The molding with the help of mechanical means includes the provision of machines and the clay is pressed into such machines to get the tiles of desired section and shape. **This method of molding is adopted for tiles having a uniform section throughout their length. The cutting of tiles to the desired length is carried out with the help of a fine wire.**

(3) Drying:

The tiles, as they come out of molds, are placed flat one above the other in suitable numbers. The different heaps are thus formed. After about 2 days, the irregularity of tiles due to warping is corrected with a flat wooden mallet. The tiles are then lifted. The edges and under surfaces are cleaned. They are stacked on edge under a shade to dry for about two days or so. **The drying under a shade prevents warping and cracking of tiles due to rain and sun.**

(4) Burning:

The tiles are then burnt in kilns. A typical kiln, known as the Sialkot kiln, for accommodating about 30000 to 40000 tiles is shown in the figure. It is circular in shape and is protected by ashed. A layer of bricks is laid flat on the rows of long narrow
flues. The burning is affected by firing wood placed in these flues. The bricks are arranged in such a way that open spaces are left in between them.Above the layer of bricks, the dried tiles are placed on the edge layer by layer. The closing of doorways is affected by brickwork in the mud. The top of the kiln is covered with a layer of old tiles.



Circular kiln for burning tiles
FIG. 3-1

The regulation of heat is important to achieve better results. The fire is gentle in the beginning. It removes moisture. It is then raised to about 800°C. It is slackened for a period of about 6 hours and again raised to white heat, the temperature being 1300°C. This temperature is maintained steady for a period of 3 hours.
The process of slackening the fire for 6 hours and then raising the temperature to white heat is repeated. The white heat is maintained for 4 hours. Finally, the flues are filled with fuel and the doorways are closed by brickwork in the mud. The kiln is then gradually allowed to cool down. It requires about 72 hours to complete the process of burning the tiles.The tiles are taken out of the kiln. The under burnt tiles are sorted out and they are placed on the top of the kiln in the subsequent burning of tiles. It is thus seen that this kiln is an intermittent kiln.A new automatic process known as the single firing technology has been found out and it has resulted in the drastic reduction of the firing cycle from 72 hours in the old double firing conventional method to a stunning average of just one hour.This new technology has reduced fuel consumption and lowered the total cost of production. The new technology has increased the quality, design, and versatility of tiles, and thus a new chapter of discovery has opened for the ceramic industry.

Second: Cement Concrete Tiles:

Cement concrete tiles are precast solid products made out of cement concrete. The product can be made in various shapes and sizes as per the requirement. These blocks are generally interlocking type and are mostly adopted for paving open surface to facilitate easy movement and for convenience in walking. Paving the walkways with such blocks besides providing the convenience of walking adds to the beautification of the area.


*The Raw Material of Concrete Tiles:

The basic raw materials for the unit are cement, sand & stone chips or gravel.

1-Manufacturing Process of Concrete Tiles (with One Layer):

The process of manufacturing is simple and standardized. Cement concrete is a mixture of cement, sand, and stone chips in correct proportions. The items are mixed in water and churned thoroughly in a concrete mixture. The process involves proportioning, Mixing, Compacting, Curing & Drying. A concrete mix of 1:2:4 cement: sand: stone chips by volume are used for making paving tiles.

All the items of raw material are placed in the concrete mixer and water added. The mixer is then rotated for 15-20 minutes. The mixed material is then discharged onto the molds. Care is taken that the mixture does not dry. Vibrators are employed during the process of pouring the mix so as to ensure that it sets well and is compact there is no porosity. After compacting the blocks are de-molded and allowed to dry for 24 hours away from direct sun. The blocks, thus hardened are cured with water to permit moisturizing or settling of cement for the next 20 days. The water in the curing tanks is generally changed every 3 days. After being cured the blocks are allowed to dry in the shade so that the initial shrinkage of the blocks is complete before they are used. This generally takes 15 days.

***Method of Casting:**

Cement tiles are made up of two different layers. This can be seen better if you look at the side of the tile.

First layer: The wear/color layer or the view. This is a fine mixture of white cement, crushed white marble (natural) pigments. The quality of this layer provides the abrasion resistance and the color and brightness of the tile. The layer is approximately 3mm thick and should be impregnated several times after the tile has been glued. The final product has a natural, lively feel and is very durable.

Second layer: This layer, which consists of a mortar of cement and fine sand, is the basis of the product and strengthens the first layer. **The second layer** ensures that the entire tile can withstand high pressure. Both layers are compressed in a special cement tile, press into one single tile. The 2nd layer is about 12 millimeters thick

***The manufacturing process:**

For each new pattern, a new copper mold is made by hand. This fits exactly in a frame, which in turn is on top of a hydraulic press. The frame not only determines the size, but also the quality of the top layer of the cement tile. The pigment gets poured into the mold, color by color, exactly according to the desired pattern. The pigment mainly consists of marble powder, fine white cement, organic pigments, and other minerals. After the mold is removed in a special way, the color layer is sprinkled (first visible layer) with a mixture of very fine sand and cement. This ensures that the abundant moisture is absorbed well. The third step of the process is the precision filling of the frame with a thicker mixture of sand and cement, which is carefully smoothened. After that, the frame gets entirely sealed and the tile, compressed in a hydraulic press. After the pressing process, the frame and the sealer are removed and the tile i carefully inspected for the desired quality and the desired pattern. Next, the tiles are emerging to harden in a water bath for 24 hours. Lastly, the tiles are stored in dry storage racks for 7 days, for the final hardening process.

Important Questions:

1- How concrete and normal tiles are made?
2- Do concrete and normal tiles crack?
3- Are concrete and normal tiles good?
4- Are concrete and normal tiles hard to maintain?
5- Are concrete and normal tiles durable?
6- What material is used to make roof tiles?
7- What is the difference between concrete and normal tiles?