

## MATERIAL

# BRICK - CELL OF ARCHITECTURE

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What brick can do! This cell material has been employed through ages to build Temple, Mosque, Stupa, Church, Warehouse, Ziggurat, Castle, Palaces, Great Bath (Mohenjo-daro) & Wall (China), Residential and Commercial houses, Port (Lothal) and even Fort. Clay was the most important raw material, through ages, to make a suitable parallelepiped shape for employing a form of enclosure.

Bricks have been used from the age of the *Indus Valley Civilization* in Indian region. As we know, it has been used since 3300 B.C. The history of Brick begins earlier than the history of architecture. We know that *Mahenjo-daro*, *Harappa*, *Dholavira*, *Kalibangan* and *Lothal* are the oldest civilizations where the bricks were installed to make buildings. Those bricks were similar in shapes, sizes and colours found from the five sites. The oldest bricks were found from the West Bengal also. *Chandraketugarh* [24-Parganas (North)], *Pandu Rajar Dhipi* (Burdwan), and *Dantan* (West Midnapur) are the evidence of the same.



We found unique Town Planning that was completely made of brick in the *Indus Valley Civilisation*. The Arians invaded and destroyed the Harappan Civilisation but it was very hard to them to destroy the structures made by the then Harappan people. The method to make bricks as well as the method of construction of building was completely unknown to the Arian invaders. That's why the Arians used to live in huts made of wood and bamboo.



At *Kalibangan*, the Citadel mound made of mud-brick is a parallelogram on a plan of about 430 feet on the East-West axis and 850 feet on the North-South axis. A unique port was found at *Lothal*, which is completely made of brick, measuring about 1180 feet long and 690 feet wide. *Lothal port* is compared with the structure of the *Vishakha-Pattanam port*.

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Actually, the oldest bricks found date back to 7500 BC in Cayonu, located in upper Tigris area. The next age of brick is between 7000 BC and 6935 BC found at Jericho. Unbaked mud-brick was used as principal building material in Ancient Egypt. Ratio of the size of bricks used in Ancient Egypt and Indus Valley Civilisation is 4 : 2 : 1. The then architects of Babylon (Iraq) in 575 BC used burnt clay bricks enormously in the entryway (Ishtar Gate). They also used glazed-bricks for decorated relief on the entryway. Ancient Mesopotamia around 500 BC used mud-bricks made of thick clay and mud, deposited by the Tigris and Euphrates rivers, was reinforced with straw and shaped into brick then dried by the sunlight. The Romans were master of brick manufacturing and took their skills to Britain in 54 AD. In Australia, the brick making started in 1788 AD and its first brick building is the Government House completed in 1789 AD.

I am not going to describe the detail history of brick. It is not be possible to write a perfect world history of bricks. It requires million volumes of books to describe.

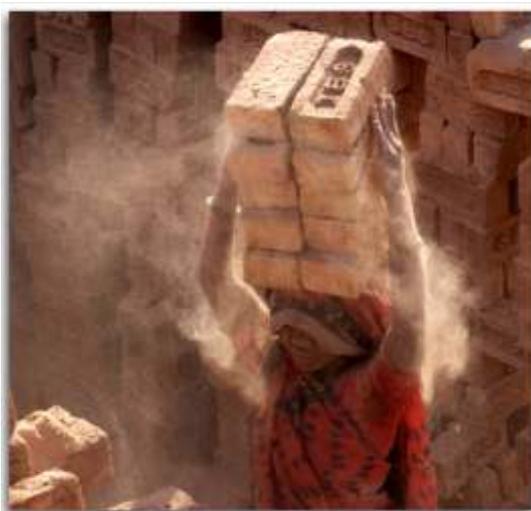
## **TYPES OF BRICKS USED FOR RESIDENTIAL BUILDING:**

### **Mud / Sun Dried Brick (SDB):**

It is also extensively used in rural India. It is the most economical too. It starts with the raw clay, preferably in a mix with 25% - 30% sand to reduce shrinkage. The clay is mixed with water to the desired consistency. The clay is then pressed into steel / wood moulds. The shaped clay is then dried in the Sun. Sometimes Rice Husk Ash or Straw used as aggregate and reinforcement. SDB is not available in the market. Villagers manufacture SDB for their local housing.



***Mud-Brick Construction***



***Traditional Bricks in use***

### **Burnt Clay Brick (BCB):**

The basic process is similar to mud brick. But there may be difference in percentage of soil and sand. A good BCB contains 60% Silica, 20% Alumina and other 20% is a mixture of Iron-Oxide, Calcium, Manganese, Sodium and Potassium. The quality of a BCB is depending on chemical substances found in the soil, the method of mixing the ingredients and the temperature to burn. The colour of the BCB depends on the percentage of Iron present in the soil, the quality of sand sprinkle on the surface of the brick before burning and the temperature of the Kiln.

It is generally available in the form of Traditional Brick and Modular Brick. The sizes of the Traditional and Modular bricks are (240 x 115 x 70) mm and (190 x 90 x 90) mm respectively. Traditional Bricks are available anywhere in our state / country. The Govt. of West Bengal is making Modular Clay Bricks in their various Mechanised Brick Factories. Now a private company is making Modular Bricks in Hooghly district. The bricks made by the state govt. are not easily available as the production cannot serve the demand of the market. The government is not interested to increase their production.



*Modular Bricks (BCB)*



*Special Form Bricks (BCB)*

What difference between the Traditional and Modular bricks! The main factor of a brick is its Crushing Strength (CS). As per various testing reports, CS of Traditional Bricks having 60 90 Kg / Cm<sup>2</sup> approximately; whereas CS of Modular Bricks is 75 160 Kg / Cm<sup>2</sup>. Water absorption of Traditional Bricks is more than 20% whereas it is 10% 12% for Modular Bricks.

You can get Traditional Bricks in various forms like Triangle, Hexagonal, Octagonal, Circular etc. Domjur in Howrah district is the place where these special shaped bricks are manufactured.

### **Fly-Ash Brick (FAB):**

Extensive use of BCB requires top-soil of the earth except in limited pockets of some river delta region. It replaces vast stretches of erstwhile fertile land with barren lagoon. It causes disturbance in ecology too. The annual consumption of BCB exhausts approximately 30 Crore tons of clay resulting degradation of top-soil cover nearly 75,000,000 M<sup>2</sup>.



*FAB manufacture in Pulver-Ash (1999)*



*FAB in use*

In either side, the Thermal Power Stations in our country produce a large quantity of Fly-Ash which affects the environment. So some agencies started thinking to recycle this huge waste. Research invented *Portland Pozzolana Cement* (PPC) based on Fly-Ash. And better result had been seen comparing to Ordinary Portland Cement. Beside this, some agencies were doing research to manufacture bricks instead of using soil. Again, research produced successful result.

FAB was developed by Central Fuel Research Institute, Dhanbad to suit the Indian environment and to meet Indian constructional needs.



*Hollow Bricks (BCB)*

Some private Brick Manufacturing Units produce various types of FAB including Hollow bricks. These units are situated at durgapur in Burdwan district. One private FAB unit produces Interlock Blocks (equal to three bricks) that is situated at a remote village near Jangipara in Hooghly district.



*Interlock-Blocks (FAB)*

FAB is also available in two forms Traditional & Modular. The Crushing Strength of FAB increases with exposure. Average Crushing Strength of FAB is 110 198 Kg / Cm<sup>2</sup>. FAB can be made of various ingredients like

Fly-Ash + Lime + Chromium Oxide

Fly-Ash + Cement + Crusher dust

Fly-Ash + Gypsum + Marble dust

Fly-Ash + Cement + Stone chips + Marble dust

The varied percentage of ingredients varies its quality. Fly-Ash reduces the porosity of a brick block. Areas with high salinity in FAB are impervious to efflorescence being free of soluble salts.

## PROPERTIES OF BEB AND FAB

Now, look into the following properties of BCB versus FAB:

PARAMETERS	BCB	FAB	REMARKS
CRUSHING STRENGTH (CS) [in Kg / Cm <sup>2</sup> ]	70	120	With time and exposure, the CS of <b>FAB</b> goes upto 200; the CS of <b>BCB</b> however varies between 30 and 90 for Traditional and between 70 & 160 for Modular bricks.
POROSITY	± 40%	12 – 20%	The lower porosity of <b>FAB</b> protects against salinity and extreme weather conditions. <b>FAB</b> can thus be used on sea fronts, marshy areas or in wet, hilly areas.
WATER ABSORPTION	± 25%	10 – 12%	<b>FAB</b> is fully comparable to <b>BCB</b> in this term.
SIZE	240x115x70 (Traditional)  190x90x90 (Modular)  270x180x90 (Hollow)	190x90x90 (Modular)  250x225x110 (Interlock)	The modular size allows much faster handling.  The Interlock size requires more physical strength of the Mason.
SMOOTHNESS	Handmade produces Rough surface & corners.  Machine-made produces smooth surface & corners.	Smooth surface, corner & edges normally produced.	Machine made BCB and FAB require less plaster on the outer face. Less mortar required for their regular sizes.  Handmade BCB requires more thick plaster on both faces. More mortar required for irregular size.

