For more information, write or call:

TECHNOLOGICAL SERVICES DIVISION
Industrial Technology Development Institute (ITDI-DOST)
Telefax: 837-2071 loc. 2265 / 837-6156
e-mail: tsd@itdi.dost.gov.ph

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COMMON BRICK MANUFACTURING

Department of Science and Technology
INDUSTRIAL TECHNOLOGY DEVELOPMENT INSTITUTE
DOST Compound, General Santos Avenue
Bicutan, Taguig City, Metro Manila, PHILIPPINES
http://www.itdi.dost.gov.ph

'Our Business is Industry…"

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Prepared by: **ELNILA C. ZALAMEDA**
TSD-ITDI

JOSEFINA R. CELORICO
MSD-ITDI

Edited by: **VIOLETA B. CONOZA**
TSD-ITDI

Cover layout by: **LUZMIN R. ESTEBAN**
TSD-ITDI

Adviser: **NELIA ELISA C. FLORENDO**
TSD-ITDI

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COMMON BRICK MANUFACTURE

INTRODUCTION

The use of common bricks as a basic material for construction has been established and practiced in the Philippines during the Spanish times. Early Spanish colonizers, in establishing towns and cities, built churches, state edifices, and houses of solid blocks like adobe, limestone, and bricks with lime sand mixture as mortar. This is proven by the existence, to date, of many ruins of old Spanish type structures. One typical example of such is the ruins of Intramuros that once confined the old city of Manila.

Common brick is described as a solid rectangular block (2"x4"x8" ASTM Standard) made by shaping plastic mass of clay which is then hardened by drying and firing. Bricks are usually fired in temperature range of 800^{o}C – 1,000^{o}C depending on the materials used and the grade desired of the product.

RAW MATERIALS

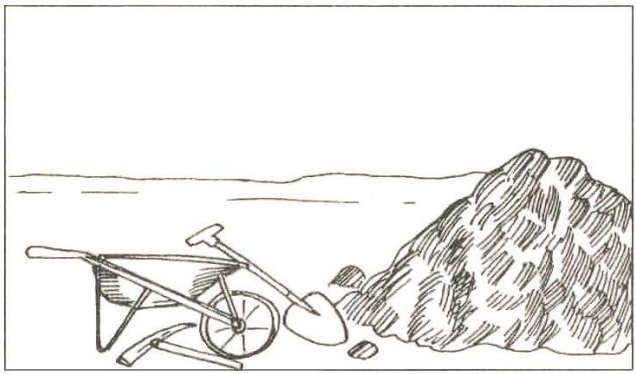
Bricks can be made from a wide range of clays, mud stones, and shales, all of which can either be secondary or primary type of materials in terms of occurrence. The secondary or water-containing minerals are produced by weathering action of water and air, while primary is of igneous rock minerals as feldspar and micas. Commonly used as material for brick-making are high iron bearing (3-10%) argellacious clays usually found in lowly elevated areas where they were deposited. These sedimentary clays contain primarily, compounds of Alumina (Al_2O_3), Silica (SiO_2), and water with minor amounts of lime (CaO), Magnesia (MgO), Soda (Na_2O), and Potash (K_2O). It is the iron present (oxides, hydroxides, or carbonates) that accounts for the wide range of colors found in finished bricks (light brown, brown red, to dark brown).

Most important of the physical properties of clay is its plasticity. When water is added, the clay can be formed readily without deformation. In most cases, the blending of highly plastic clay with non-plastic material, like sand, chamote or less plastic sandy clay gives a better quality product.

PRODUCTION OPERATION

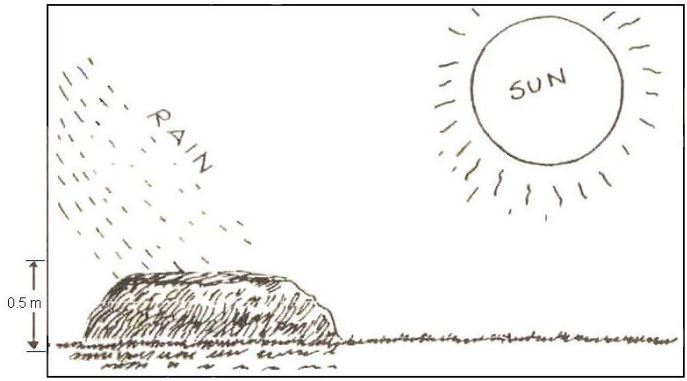
1. **Mining**

   Clay is taken from the mine by hand-digging with the aid of pick-mattock and shovels. Hand-sorting of unnecessary impurities such as stones and roots is done at this stage. The clay is then transported by wheel borrows, to the open pit-stock storage where it is exposed for weathering.



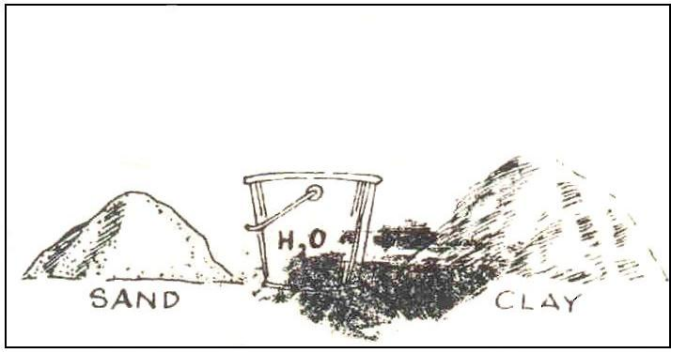
2. **Natural Weathering**

   Open exposure of clay to natural action of sunshine, rain, and wind helps in the natural disintegration of clay lumps and increases the clays workability. Recommended height of stock pile is 0.5 meter to be exposed in not less than 2 months.



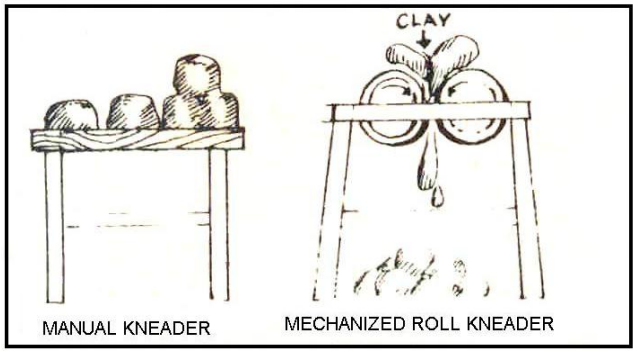
3. **Proportioning and Proper Mixing**

In order to get the desired properties of color, hardness, and strength, proportionate mixing of clay materials and sand is necessary. For manual process, sand can be spread proportionately over clay layers. This is done alternately like piles of sandwiches. Water is sprinkled over the layers of sand and clay in appropriate ratio per batch. Soaking is required for at least overnight, to guarantee an even distribution of water within the batch before kneading.



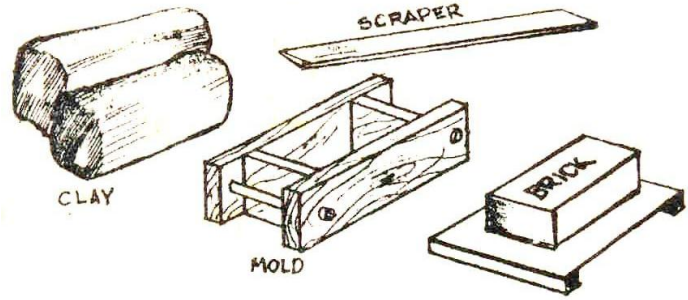
4. **Kneading**

Clay before forming is prepared by wedging to attain a homogenous plastic clay. This can be done manually, with two hands pressing the clay is a rhythmic motion or mechanically with the aid of a roll kneader or pug mill.



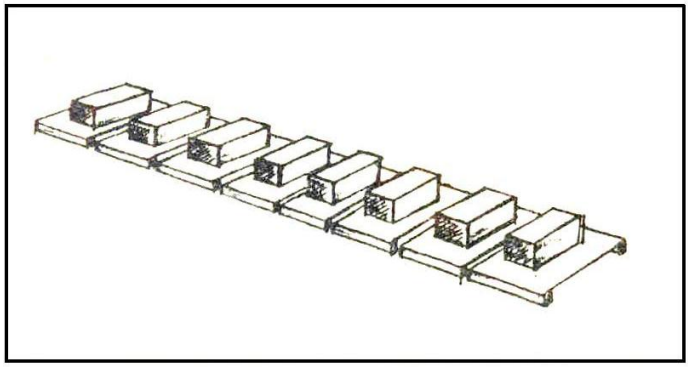
5. **Forming**

Clay blocks of the desired dimensions are formed thru the use of a rectangular wooden frame as mold. The clay is thrown, with some force, into the mold and excess clay is scraped by a scraper. The formed clay brick is released from the mold by slightly tapping the mould. The brick is left on a pallet for drying.



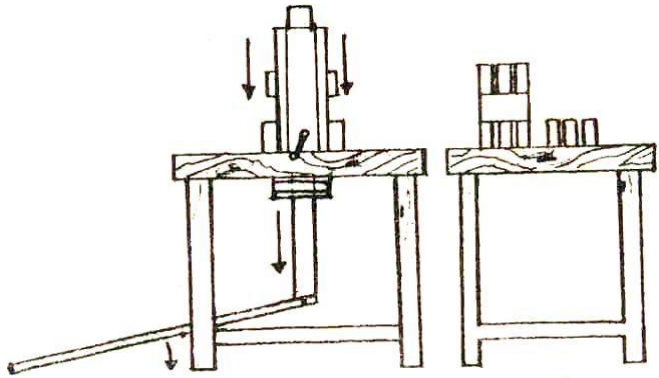
6. **Pre-drying**

Before pressing stage partial evaporation of mechanical water from newly-formed bricks is driven off to attain the desired hardness. Formed bricks are usually stocked in pallets, dried for one day, then transferred to pressing section.



7. **Pressing**

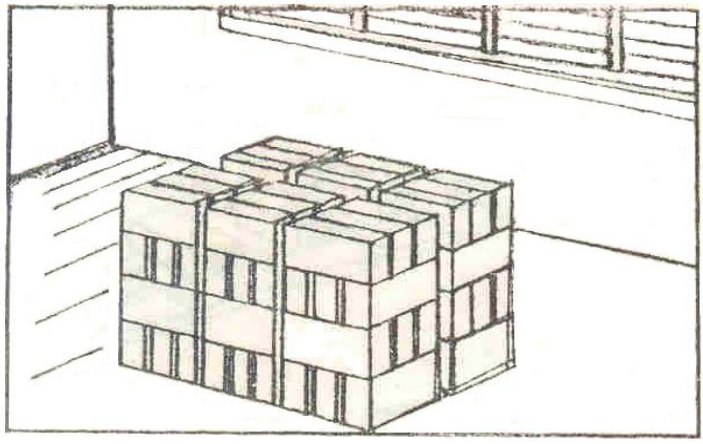
Final forming of bricks is done with the aid of a simple wooden pressing machine. The operation makes the body a little more compact and assures the uniformity of shape, smoothness and size of product.



WOODEN PRESSING MACHINE

8. **Final drying**

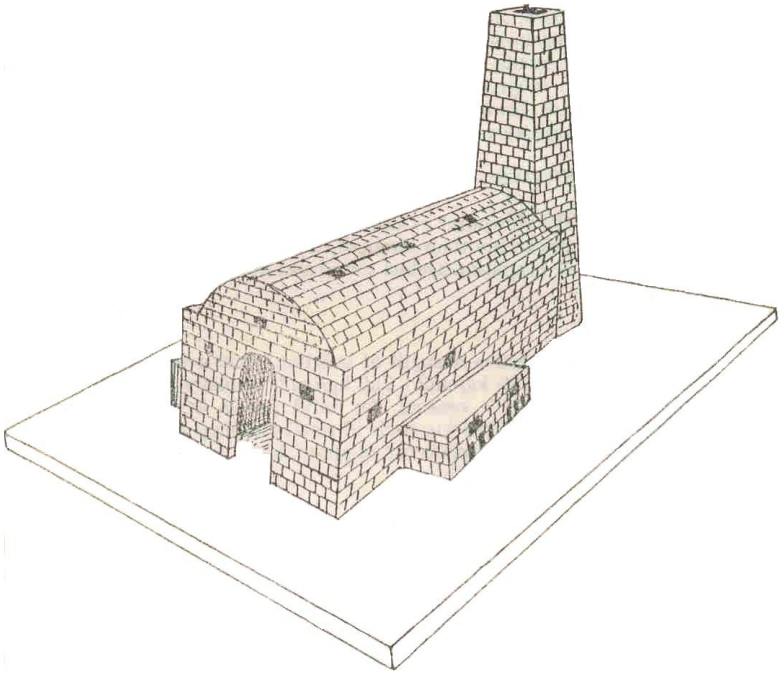
Before bricks can be fired, the water which was needed to make the clay plastic during shaping/forming must be driven off. Without artificial means of drying, it will require 2 weeks or more to dry a batch of green bricks under ordinary condition.



9. **Firing**

Dried bricks are generally fired in kilns with temperatures ranging from 800°C to 1,000°C. The operation consists of loading the bricks inside the kiln, and the actual firing. The bricks are carefully piled up in accordance with a prescribed layout, to allow even distribution of heat. After firing, the bricks are unloaded and inspection is done.

For small-scale producers, a scove kiln can be used. This is a semi-permanent kiln that can be built at lower cost.



PERIODIC KILN

BRICK USES

Brick is the simplest and most ancient of all building materials, but no other building material has enjoyed such wide-spread and continuous popularity. This enduring public acceptance is based on the unique combination of properties which brick offers to the owner and builder. This one material can be used to enclose a structure with a decorative effect, load-bearing and weatherability, which makes it exceptionally durable and requires practically no maintenance. Because of the versatility of the raw material, which can readily be molded into a great range of shapes and sizes. Modern developments in brick construction have shown that when attention is given to efficient masonry work, brick construction can prove cheaper than many of the newly developed building systems.

BRICK PROPERTIES

From the viewpoint of the user, the most important properties of bricks are their strength, their absorption properties and their insulation against sound and fire.

STRENGTH

The compressive strength of building bricks generally varies from about 50 kg/cm2 – 750 kg/cm2. In many applications (e.g., in brick veneers, for infill panels in frame structures or for load-bearing walls in small buildings of one or two stories) this strength is not required, but it can be useful in engineering applications.

ABSORPTION PROPERTIES

The power of the brick to soak up water is one of its most useful characteristics. When the bricks are being laid, their suction plays an important part in developing good bond with the mortar, and in the finished building, the absorption of rain by the bricks reduces run-off which might otherwise cause trouble at flashings and around windows or openings. The water absorbed during wet spell is harmlessly evaporated off again when the weather clears.

INSULATION

Insulation against air-borne sound depends more on the mass or weight of the wall than on anything else. A solid brick wall sets the standard for sound-proofing in both residential and commercial construction. The fire resistance of brickwork is also high because the material is inherently resistant to fire, and its low thermal conductivity ensures that heat is not quickly transferred through brick walls. Fire rarely damages brickwork in a building, although thermal expansion of unprotected steel columns girders or roof trusses may cause displacement or even collapse of brick walls.

ASTM – STANDARD SPECIFICATION FOR BUILDING BRICK

Physical Requirements

Designation	Minimum Compressive Strength (Brick Flatwise) Gross Area, Kg/cm^2		Maximum Water Absorption by 5-hour boiling, %	
	Average of 5 brick, kg/cm^2	**Individual, kg/cm^2**	**Ave. of 5 brick, %**	**Individual, %**
Grade SW	211.37	176	17.0	20.0
Grade MW	176.14	155	22.0	25.0
Grade NW	105.68	88	No limit	No limit

NOTE:

SW – Brick should be used in any region when the units are in contact with the ground, in horizontal surfaces, or in any position where they are likely to be permeated with water, i.e., when used in floor.

MW – Brick forms satisfactory in wall areas above grade in the no weathering region, where the average compressive strength of the units is at least 176.14 kg/cm^2.

NW – Brick not exposed to weather maybe Grade NW when used in walls and shall be Grade SW when used in floors.

ASTM – American Society for Testing Materials

JIS – Japan Industrial Standards

Physical Properties

% Water of Plasticity	13.0	40.7
% Drying Shrinkage	0.00	13.0
% Firing Shrinkage (800°C – 1000°C)	0.00	3.4
% Porosity	20.80	36.00
% Water of Absorption	8.62	42.88
Specific Gravity	1.57	2.32
Modulus of Rupture, kg/cm^2	3.35	100.40
Compressive Strength	83.69	167.40