

STUDY AND ANALISYS OF TRADITIONAL BUILDINGS IN NIGER

1.1 ENVIRONMENTAL ANALYSIS OF NIGER

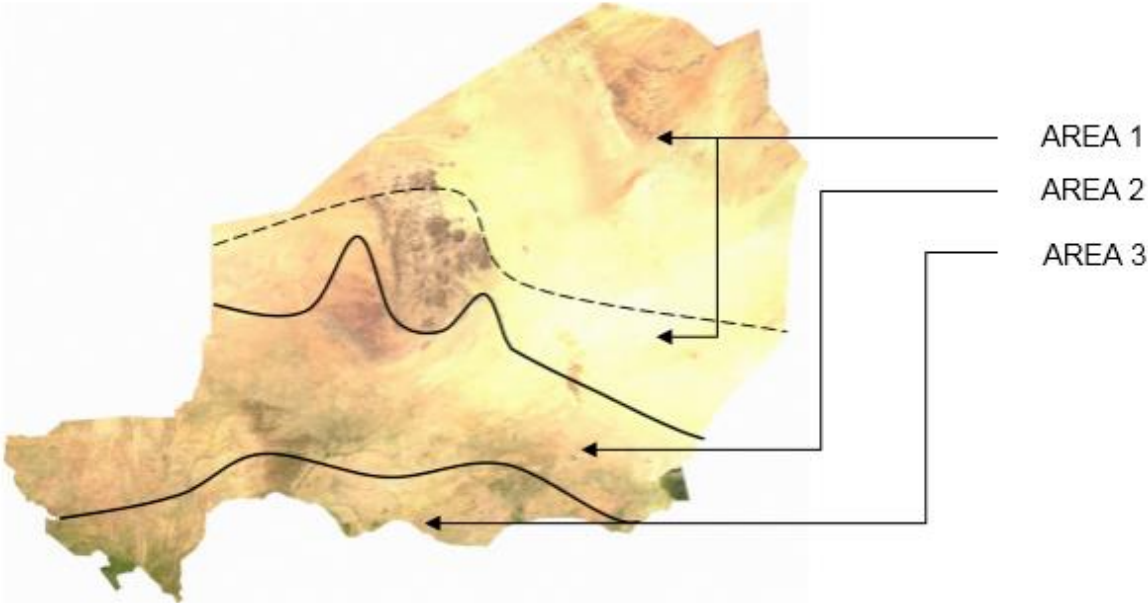


Image which shows the segregation of Niger as the landscape

The division of the country of Niger, reflected in the picture above, is determined by differences in both landscape and so constructive that can be found in each area.

**AREA 1: The Sahara Desert, the South Saharan steppe and woodlands.** This area grouping these two environments is because throughout the country of Niger have the same landscape, except for the central mountain range, in addition to the low diversity of traditional buildings in the Sahara Desert.

REFERRING: Sahara Desert



**CLIMATE:** Climate of the most stringent in the world, torrential rainfall with a prognosis of less than 25mm annually.

**VEGETATION:** Acacias, palms and tamarisk.

**WILDLIFE:** Camels and goats.

**LIFESTYLE:** The style of people living in the Sahara desert with nomads carry their homes and everything you need with them.

**MATERIALS AREA:** Trunk, plant and animal fibers.

**AREA 2: The acacia Savannah of the Sahel:**

**REFERRING: Tahoua**



**CLIMATE:** Tahoua has an arid climate. On average the temperature of the town of Tahoua is always high. January, February, March and August are dry months. Furthermore, May, June and September are the rainy season. Average temperature of 29°C. Average maximum temperature of 36.2°C. Average minimum temperature of 21.9°C. Annual rainfall of about 365 mm. Temperatures drop sharply at night.

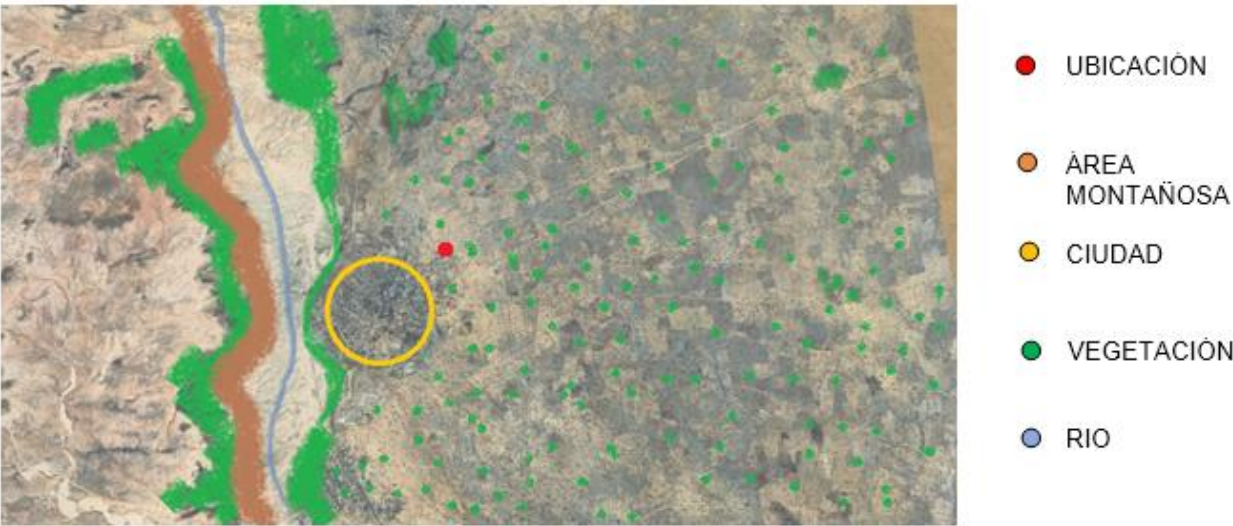
**VEGETATION:** The land area is cultivated, still some natural vegetation is preserved. The landscape is mostly covered with bare areas.

**WILDLIFE:** cattle, goats and sheep.

**LIFESTYLE:** A major administrative, agricultural and commercial center of the area. It's a farming community and trade center frequented by Tuareg and Fulani pastoral nomads. A teacher-training school is in Tahoua.

**MATERIALS AREA:** Materials such as gypsum and phosphate mines are extracted.

**REFERRING: Filingué**



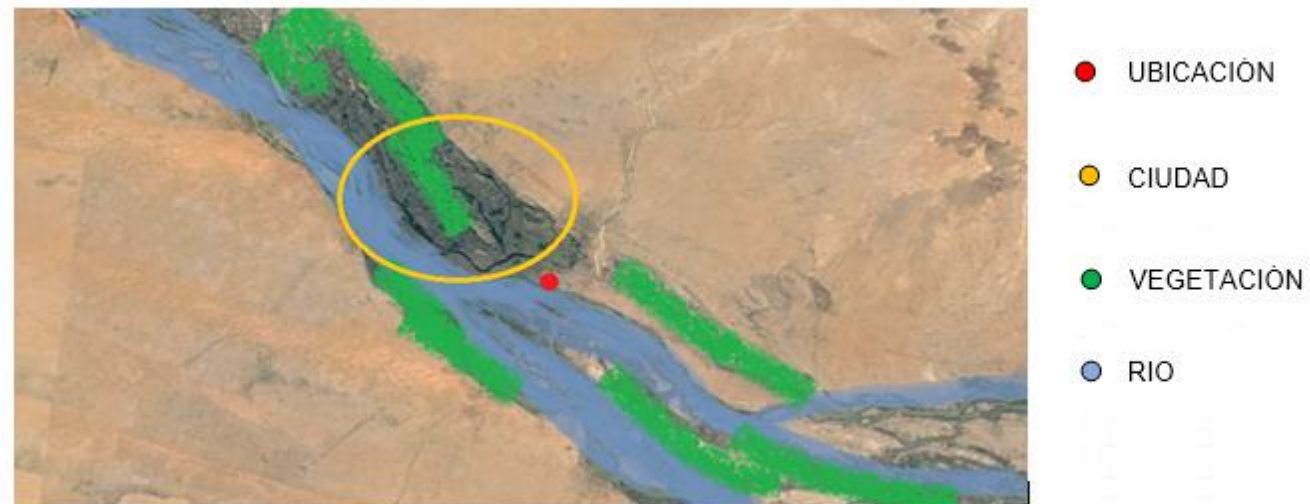
**CLIMATE:** Tropical climate. Heavy rains in winter and a dry summer. The average temperature is 29.2°C. Annual rainfall of 363 mm.

**VEGETATION:** The landscape is covered mostly by uncultivated areas, most of the natural vegetation is still intact.

**WILDLIFE:** Vacas, cabras y ovejas.

**LIFESTYLE:** It is an economic and administrative center of the area. It is populated by the Hausa, Tuareg, Fulani, Bambara and Yoruba. They live mainly on agriculture. They have serious problems such as food shortages and lack of access to fresh water.

**MATERIALS AREA:** The soil in the area is high in arenosols(Ar), soils with sandy or loamy sand texture.

**REFERRING: Kokomanimè**

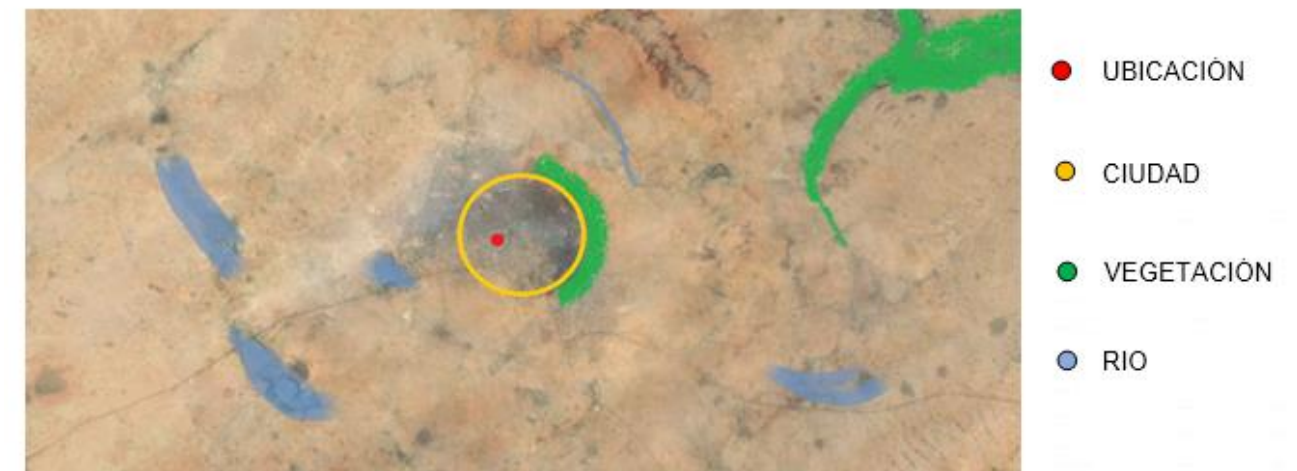
**CLIMATE:** Kokomanimè has a semi-arid climate. The average temperature is 29.4°C. Annual rainfall of about 345 mm. Rainy summers and dry winters.

**VEGETATION:** The land area is not cultivated, most of the natural vegetation is still intact. The landscape is mostly covered with closed to open grassland.

**WILDLIFE:** They raise cattle, cows, goats and sheep.

**LIFESTYLE:** Kokonanimè is a densely populated region in Tillabéri city. Predominantly Hausa-Fulani. Its economy is primarily nomadic pastoralists. Their wealth depends on the number of cattle they have and some of the products they produce are sold.

**MATERIALS AREA:** The soil in the área is high in arenosols(Ar), soils with sandy or loamy sand texture.

**AREA 3: The western Sudan savanna.****REFERRING: Zinder**

**CLIMATE:** Tropical climate. It rains more in the winter than in the summer. Average temperature of 28.1°C. Average maximum temperature of 34.9°C. Average minimum temperature of 28.1°C. Annual precipitation of 411 mm approximately.

**VEGETATION:** It is a dry sheet lined mainly formed by large trees and tall grass.

**WILDLIFE:** Still surviving species of large mammals in the region, but many of them are in danger of extinction due to hunting.

**LIFESTYLE:** Zinder is the second largest city in Niger where they live mainly Hausa and Tuareg. Very important economic and commercial center. Zinder residents have access to prepaid phone. This ecoregion is degraded by human activities (agriculture, fire, logging for timber and charcoal, hunting ...)

**MATERIALS AREA:** The city has many distinctive granite rocks.



## 1.2 STATE OF THE ART OF MAIN BUILDING MATERIALS NIGER

### 1.2.1 MAIN BUILDING MATERIALS NIGER

#### 1.2.1.1 LAND

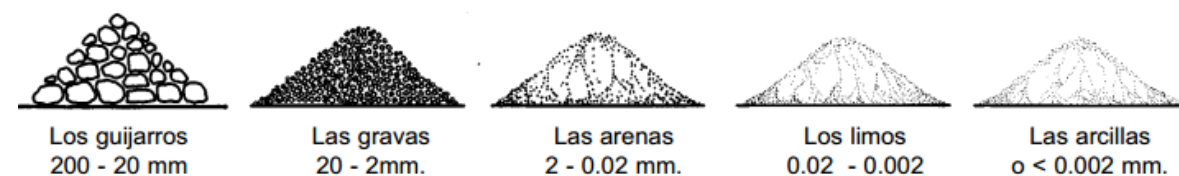
The land has been used by various civilizations throughout history. At high-scale constructions such as walls, castles, fortresses and other simple forms of construction such as houses, barns, etc ... There are great examples in Mesopotamia building with earth in the third millennium BC, those that formed the genesis of Ancient Egypt or the people who gathered around the "Kasbah" Moroccans. Also, the architecture Originally Yemen or most of the Spanish heritage of different periods, rural are good examples of this ancient building technique.

These constructs are identified by the repetition of a building module of different sizes to create a system, as it could be inside an enclosure or partition, which, with the help of wooden structural elements generate the whole building. Depending on their size, they differ between land mass, adobe (modules of small size, the size of the traditional brick) and mud (large modules, which often exceed the square meter of surface)

### EARTH AS A CONSTRUCTION MATERIAL

Before you start with the constructive analysis of land, it is necessary to perform an analysis of the characteristics of the same characteristics.

Land is the dispersed solid material constituting the surface and structural layer of the crust, having a variable thickness; is the result of the transformation of the rock, as a result of the simultaneous interaction of various physical, chemical and biological processes over time. The rock is broken into smaller particles ranging from gravel to clay, the first layer contains particulate organic matter from the decomposition of living things, these layers are used for agriculture, while the other layers are suitable for construction.



As a building material, earth offers numerous chances against the most common technologies of modern architecture: in addition to being a material highly accessible as it can be found almost everywhere in the world, provides construction good insulation and noise, due to its specific weight and its thermal inertia.

Production of construction by this construction system used primarily local resources, both the raw material and in the case of labor, which does not need to possess a high degree of specialization due to simplicity of implementation.

Despite being a building material widely used throughout history, their use has been very limited at present in developed countries, in the absence of implementing legislation, making it impossible to study and correct classification, predominance delegating more standard materials.



## ADOBE STORY BRICK

Although land is a material that requires a series of simple techniques for laying, along history, have been developed, starting from the simplest formula: the Earth Fired Brick.

The world's oldest brick was found in 1952 in excavations of Jericho, on the banks of the Jordan River, dated between 8,300 and 7,600 BC; these bricks have a size and shape similar to a loaf of bread, which were performed by scrape mud with a stick, mixing it with water and kneading to give a rectangular shape, allowed to dry in the sun, before being placed in rows, together with mud mortar. Subsequently, between 7,600 and 6,600 BC, the size and shape of various brick making thinner and elongated, reaching a size of approximately 400 x 150 x 100 mm.

East weather allowed the development of walls made without using mud bricks, this change was made because of the advantages presented: first, the bricks are transported more easily than the mud, so that the wall could built further away from obtaining raw materials, secondly, and more importantly, to put the already dried bricks, a construction element of increased resistance was achieved; finally dried by standing, it was not necessary the incorporation of a formwork system kept straight during the time of drying wall.

It was not until the period between 6900 and 5300 BC when Mesopotamian perfected the art of drawing using the mold. The system consisted of fresh clay deposit in a bottomless wooden mold, placed on the ground; after it is smoothed with a wooden upper mold to remove excess clay, after which the mold was removed and deposited to the side, to continue the process whereas, the above is left to dry in the sun. This method was perfected by the Egyptians adding straw to the mix, allowing mold hundreds of identical and perfectly rectangular bricks in one day.

This method, to which solar radiation is used cooked, and wherein the artificial addition of heat for cooking is not needed, is the base mud and adobe construction, remaining almost unchangeable since.

## CONSTRUCTIVE METHOD

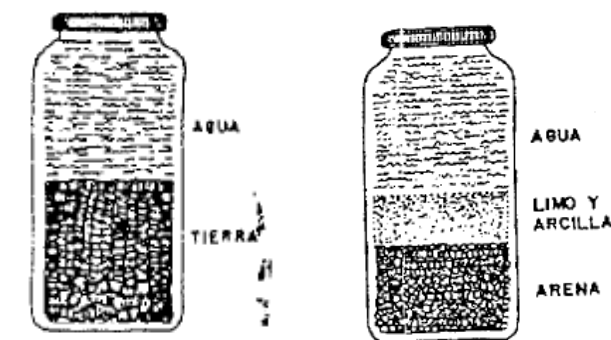
As explained above, earth construction has developed multiple construction techniques, the most prominent adobe and rammed earth.

## Land selection

As explained above, earth construction has developed the land for building bricks should contain 25 to 45% silt and clay and the rest sand, with a high proportion of clay should be 15 to 17% the land can not be cultivated. There are several tests to determine the quality of the land for building bricks, including son.

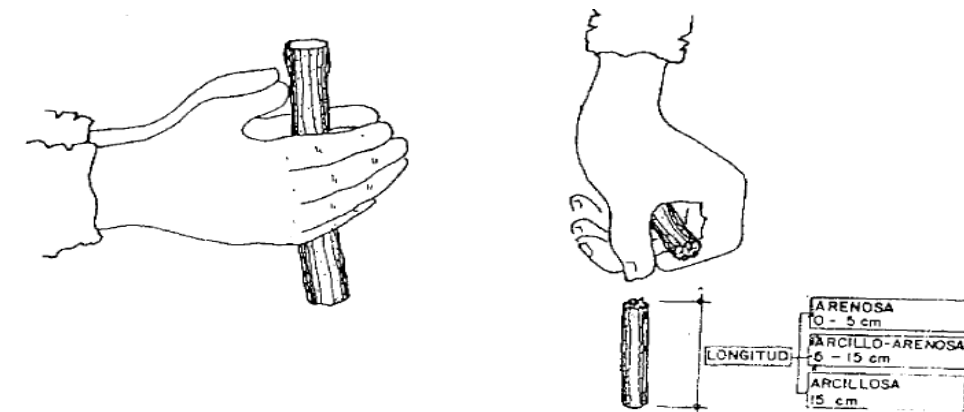
## Grading test

Earth is filled with sifted by a screen 4 a bottle of one liter to half of it, then the remaining portion is filled with water, the bottle was shaken, allowed to stand until all pellets are separated, finally measured the different layers, and we will know if the ratio is correct. Sand, between 1.5 to 3 times the amount of silt and clay.



## Plasticity test

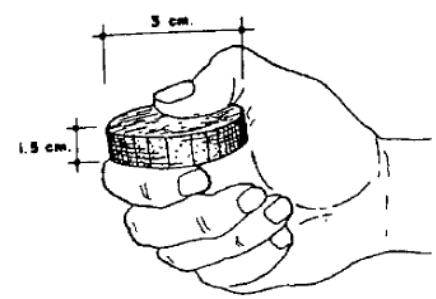
A roll of 1.5 cm in diameter with moist soil, airborne the length of the end portion that is formed is measured, can create 3 different situations



Sandy: Inadequate, when the roll is broken before 5 cm  
Sandy clay: Fair, when the roll is broken between 5 and 15 cm  
Shale: Inadequate, when the roll breaks from 15 cm

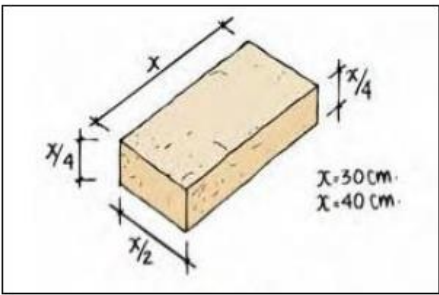
Resistance test

Three discs 3 cm diameter by 1.5 cm wide are created, they are dried for 48 hours and then crushed using fingers, can find two types of cases, low strength, poor, when the disc is easily crushed , high strength, adequate, when the disc is broken with difficulty or with a dry sound.



ADOBE

Adobe technique is similar to the current fired brick is unfired clay pieces with rectangular shape and variable size, the most common sizes are between 30 x 15 x 7 cm to 40 x 20 x 10 cm, while maintaining a ratio (1: 1/2: 1 / 1/4) between length, width and height of the piece



The development consists of adobe mud placement in an almost plastic to wooden molds of the desired action. The drying must occur slowly and sudden changes in temperature by placing parts separated from each other to facilitate air circulation mud, leaving enough space for the passage of people. In times of high temperature is necessary to cover the pieces with sand or ashes. To complete the drying process is necessary to turn to three days, after a minimum of seven days longer in condition for use, times vary by location and season.

DIAS DE PRODUCCIÓN												
1	2	3	4	5	6	7	8	9	10	11	12	13
Extracción - Transporte	Mezclado -Preparación - Curado	Mezclado - Transporte - Moldeado	Secado 1			Secado 2				Almacenamiento	Transporte	Construcción

ELEMENTS

Foundations

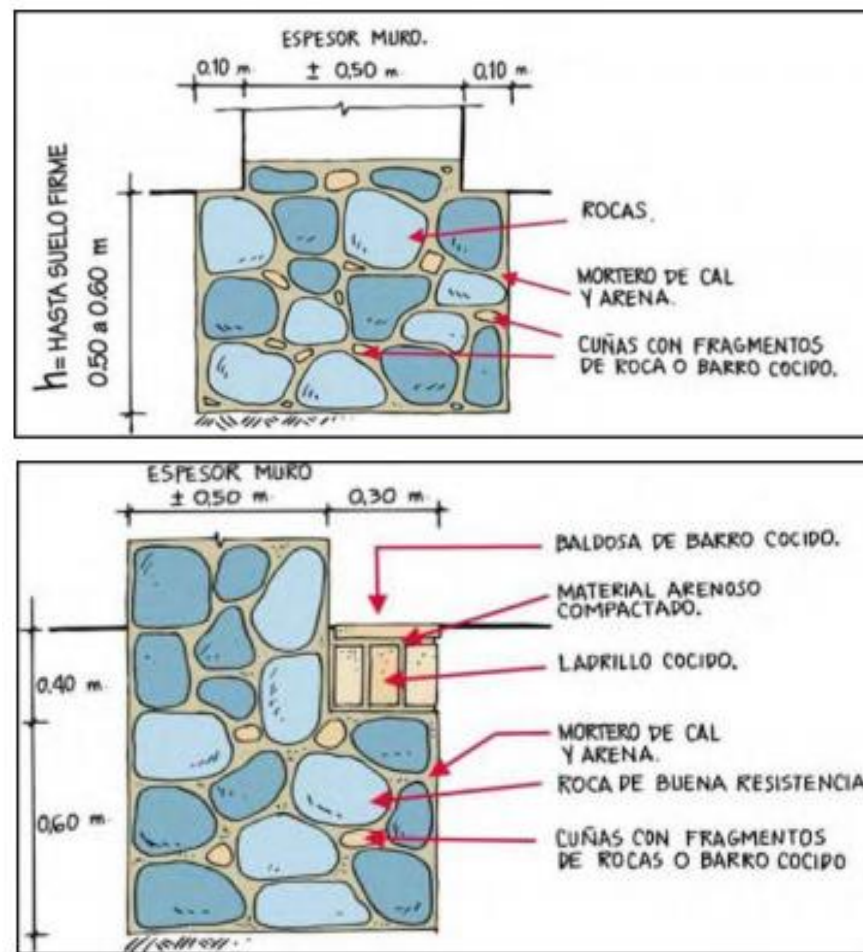
The initial base construction is the foundation of clay, consisting of a continuous foundation under the walls prepared by collecting rocks and compacted fill material, creating a solid foundation to endure the actions of the structure.  
The foundation depth is variable, depending on the height at which the soil is firm.

The most frequently when laying the foundation forms are "L", generally used for the footings of the facade walls or footings medians, or as "T", which is often used for shoes intermediate load walls, although prismatic blocks of the same width of the wall can also be used.

Dimensions typically up foundations at the base ranges from 50 to 60 inches, while the surface on which rest the bearing wall reaches 50 cm. Braces floor joists will run you about 10 inches in the case of the beams in a "T", while reach 30 inches for beams in the form of "L".

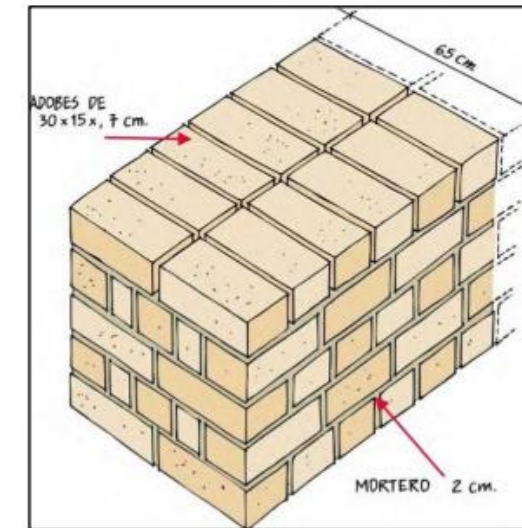
In the case that a building is projected on sloping ground, the foundation will be projected to the upper bound, resulting in rooms that are usually used as storerooms, warehouses, etz ...





### Cladding

The adobe walls are made by placing rows successive adobe blocks, linked by mud mortar, it is important to use mud mortar as a binder material if we use more resistance than adobe fractures could occur at the parts.

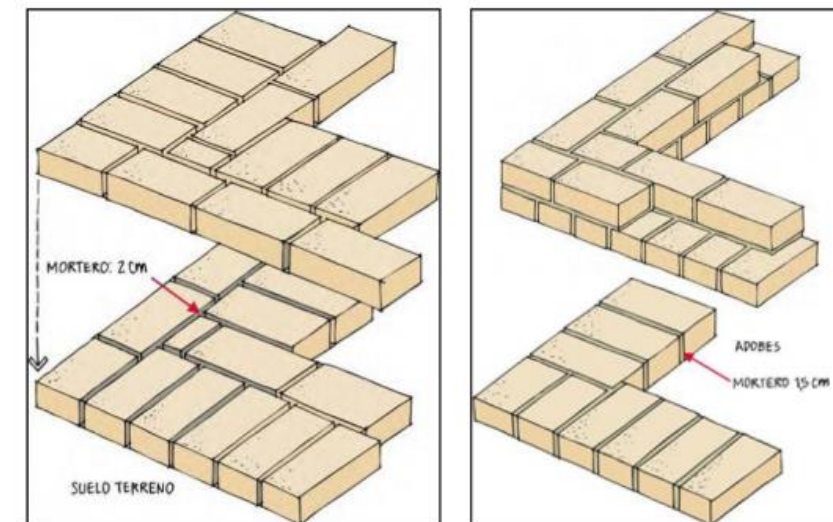


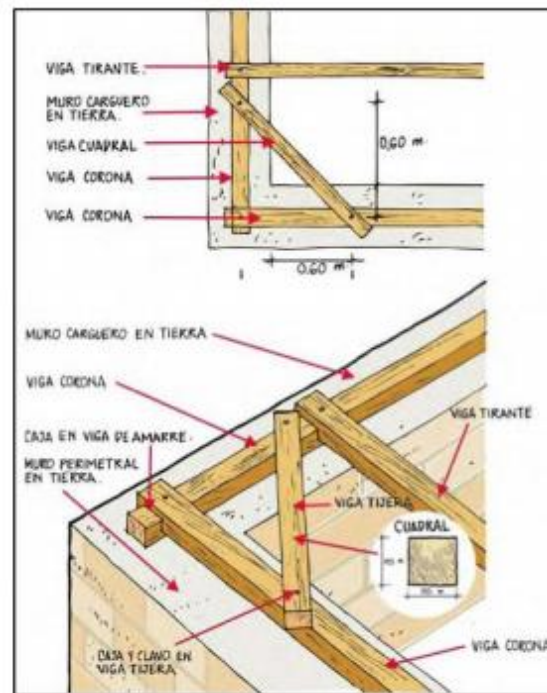
To make corner joints in various locking techniques are performed similar to those used with existing bricks.

### Plinth

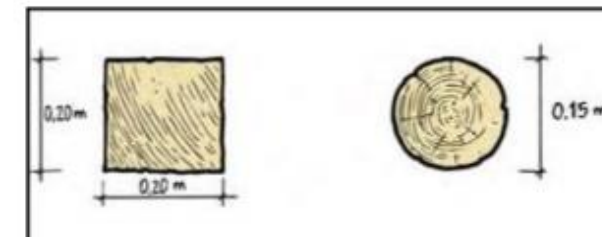
The on foundations have the function of protecting the main wall of moisture, and other external factors that might affect the basis of the structure.

These elements are raised about 50 cm from the ground, rocks and compact soil used in the case of mud, whereas for the adobe baked bricks can be used.



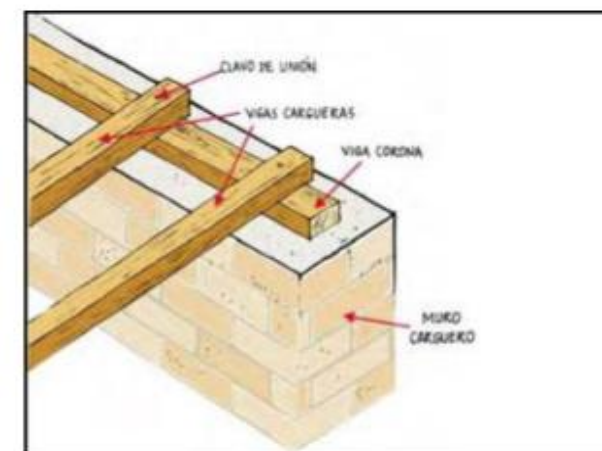
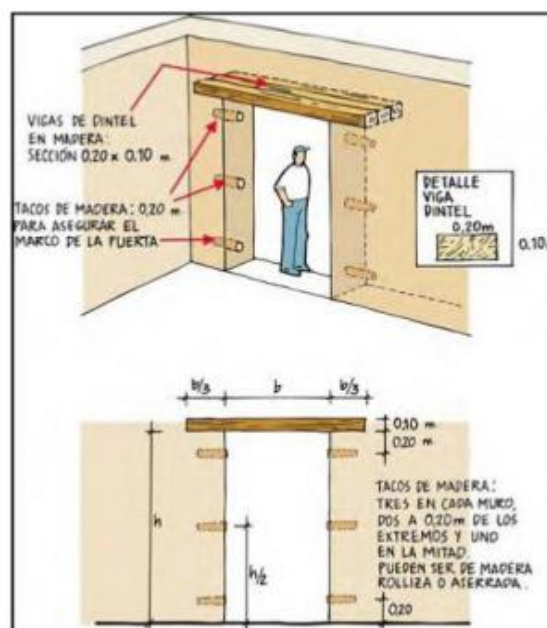


The floors are made by means of a lattice of wooden slats, these slats can be logs, between 15 and 20 inches in diameter, or slats rectangular or square section, of a section of approximately 20 by 20 centimeters. The separation between the beams "freighters" typically 50 inches, but may reach lengths of one meter.



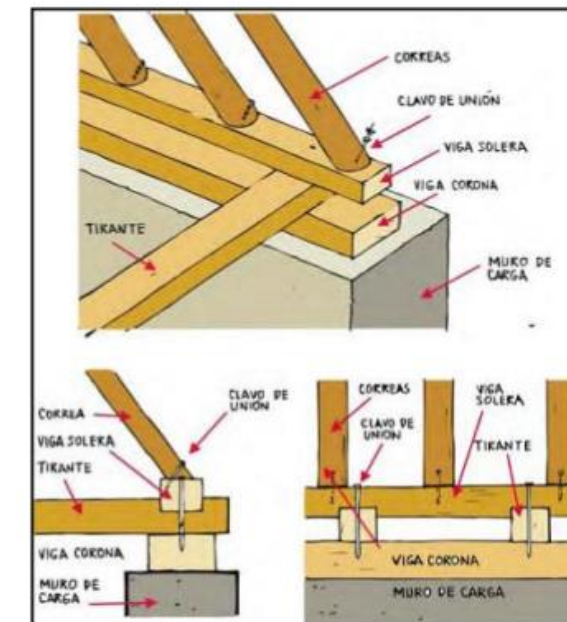
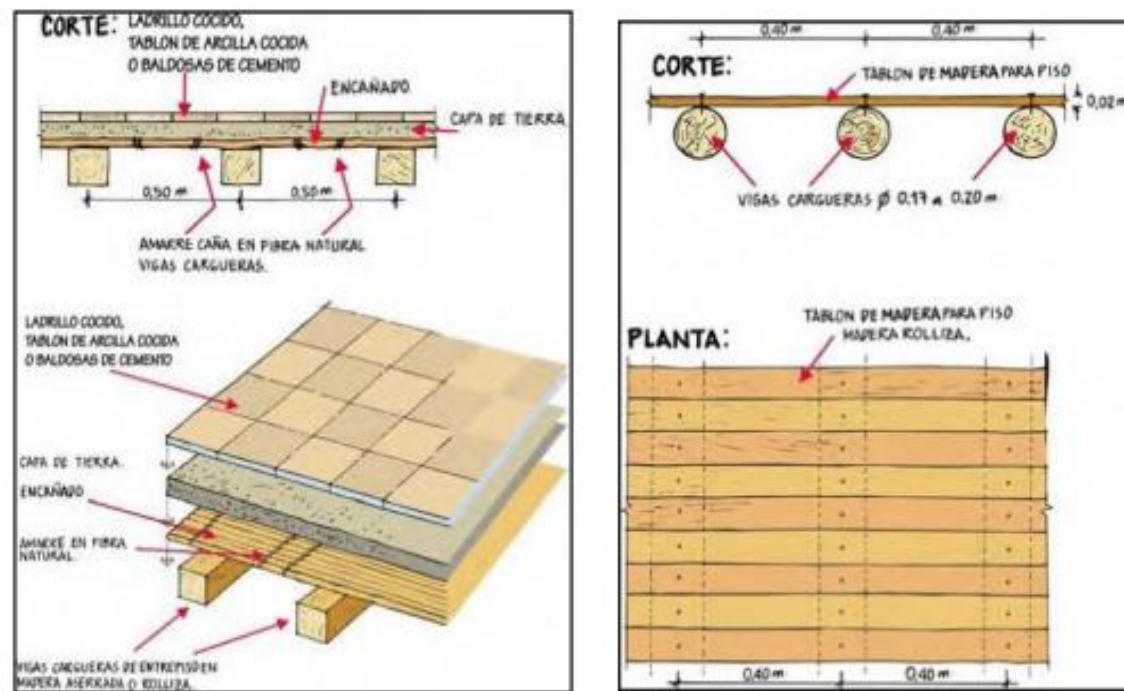
The supports in the bearing walls normally take the form of a wooden batten supported in the enclosure, using a series connection means of nails, performing in the case of the corners to avoid possible triangulation deformations in the structure; once made the support, and in order to hide the Wrought structure, are usually placed a series of blocks of adobe.

For the preparation of the doorways and windows, often used a number of beams in a section approximately 20 inches by 15 inches, with minimal support on the wall in both the span of 40 inches



On the lattice of wooden beams unless other size strips or planks that are nailed to the wooden structure is placed, then a layer of soil that makes the basis for further paved placed

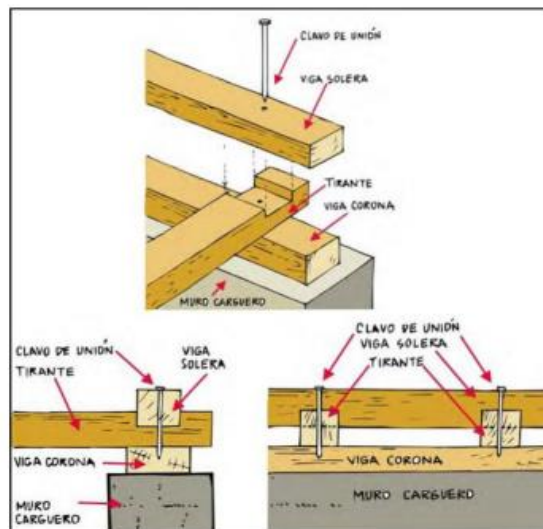




## Cover

The cover is performed by means of a wooden gable, following solution "par and row", due to its simplicity of preparation:

On the wall of mud or adobe created a beam coronation, which serve to support the straps beams, which are responsible for the distribution of the load on the beam coronation, these straps should exceed the load-bearing wall is placed to protect building eaves of the roof.



On the straps, on which we shall call a ribbon stirrup, the slats are placed known as peers, who are responsible for giving shape to the slope of the cover, which will go flat on the deck in a central ridge beam.