

ADOBE STRUCTURES AS OUR CULTURAL HERITAGE AND THEIR FEATURES

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Abstract

History indicates that the very first homes were built with the use of natural and local materials. Adobe (which is produced from soil) was an important building material and it was used by the groups that established the first settlements. The archaeological excavations (especially in Anatolia and Mesopotamia) continuously prove this indication.

At first, humanity led a life in migrant shelters against the harsh and destructive conditions of the nature, but later gave the most beautiful examples of architecture by using materials that he found in his vicinity. Soil has been used as a building material until today and still continues to be so, especially in Anatolia, Mesopotamia, Yemen, Libya. Soil is a very economical material that can be easily shaped. It can keep its form against natural effects and has a very high temperature and permeability resistance.

Technological developments have influenced the whole world and provided numerous conveniences and created many positive effects, however they also brought with them a lot of environmental problems that affect the nature and the mankind. To resolve such problems (such as the change in climatic conditions, the increase in temperature and drought, the extinction of some species), the humanity must design structures that are sensitive to the environment.

Considering human health and unification with the nature in a building design that is sensitive to the environment, the most suitable material to provide such qualities would be the soil based adobe which has been used both in rural and urban settlements since the Çatalhöyük Neolithic settlement in Anatolia.

In this study we will examine structures that were built with soil based material, by giving examples from the past to the present. These structures can be continued not only in Anatolia and Mesopotamia, but also in different parts of the world.

Keywords: Anatolia, clay, adobe, structure

History Of Adobe Use In Structures

In history, adobe was used as the main building material in many parts of the world (especially in Mesopotamia) in military, religious and civil architecture. The Mankind has been in a constant need for certain materials to for his survival since his very first existence. Neolithic age is an important revolution and the people in this age started to domesticate animals, engaged in farming and constructed shelters. Most likely, the Mankind continued his life in the area that he settled in the Neolithic and the Chalcolithic periods and in this process, he built living areas by using local materials found in his close vicinity. As a result, he started to live in permanent settlements and he built shelters by shaping and combining the land and forest products, various stones found in stream beds and materials such as reeds and straw.

"It can be easily said that the soil use (soil being a very simple tool) is as old as the Mankind. The soil that we walk on softens and becomes muddy by rain water, floods and puddles. It's a well known

fact that the human and animal tracks left on soil eventually dries and hardens with the sun and air. So it is very likely that the idea of shaping the soil by kneading it with water and drying it in the sunlight is a product of this first intuition and principle.”(ÇELEBİ 2012)

Adobe has been a major construction material from the very beginning of the history and it is still widely used in the present day in Central Asia, Asia Minor, Africa and in many other regions such as South America. We frequently encounter single and multi storey buildings that are made of adobe in many countries and in Anatolia. Adobe has a rather widespread use and it is produced by certain technical specifications. As a result, the soil turns into structures.



Figure 1. Dark Regions are used to show the adobe.(Ref: Acun Seden, Erol Gürdal A Renewable Material: adobe, adobe with plaster)

The Making of Adobe

“In order to make adobe, the soil that is used in the making must have certain qualities, such as the viscosity in its chemical structure.

“The soil type used in the making of strawy adobe consists of two main materials:

a) The bonding fine material called “colloids” if the diameter is less than 0,001 or “clay” if the diameter is in between 0,001 – 0,005 mm

b) The filling coarse material which is the coarse section that serves as the filling agent between the bonding material. They are called;

“Fine sand” if the diameter is in between 0,05 -0,25 mm,

“Coarse sand” if the diameter is in between 0,25 -2 mm,

“Pebble” if the diameter is greater than 2 mm.” (ÇELEBİ 2012)

So in the light of the above mentioned information, we can define adobe as a combination of the fine-grained sand and the stoney mineral aggregate with clay. If the soil does not possess the specified qualifications, then sand and clay must be added in order to bring the soil to the right consistency for adobe making. The mortar can be slurried by adding water and straw.

“For the quality of adobe clay, the water which will be added to the soil must be adjusted properly. Just as in the making of concrete, the

mixing water should be at the optimum value. If water is added excessively, the drying of the adobe will be very difficult and shrinkage problems will occur. The durability of the adobe will decrease as well.” (ACUN, GÜRDAL 2003)

For making adobe that is suitable for construction, the mud is poured into wooden molds and then dried in the sun. Adobe sizes varies according to the different regions of the world, but especially in Anatolia, the sizes are as follows:

Length: 30 -35 cm

Width: 15-17 cm

Height 10 - 12 cm



Picture 1. Adobe mold

Adobes in full size are called “the mother” while the ones in half size are called “The lamb.”



Picture 2. Adobe making

Today adobe is still used extensively as a building material in the Eastern Anatolia, the Southeastern Anatolia and the Central Anatolia. Its history goes back as early as 9000 thousand years ago. Excavations clearly show that the use of adobe in Anatolia campus was widespread. For example, in the construction technique of the ancient cities such as Çatalhöyük and Bogazköy, we clearly observe that it was adobe that constituted the basic structures.

Two Cities in Anatolia That Were Built with Adobe

Today, adobe (which is still used as a construction material) gives its best examples in Anatolia. One of the best examples is the Çatalhöyük campus and its history goes back to the Neolithic and the Chalcolithic periods. Çatalhöyük is one of the first cities that used adobe. UNESCO has considered it as a world heritage site. The city is in Central Anatolia, in the province of Konya. It's history goes back as early as 9000 years ago. It continued its existence between 7400-6000 B.C. As a result of its reconstruction, 18 layers of settlements were formed. The city was constantly built on itself (in layers) as a result of the abandonment and the filling of the old houses. The largeness and the high population of Çatalhöyük (which surfaced in the archeological excavations and research) shows that they had a strong understanding for art, culture and architecture. The houses were built adjacent to each other and none of them has stone in its structure. They were completely built with adobe.



Figure 2. Çatalhöyük City plan

These adobe houses usually consist of a warehouse, two rooms, a cellar and a kitchen. Their designs are completely identical. During the excavations, no structural elements such as windows and doors were observed. The houses are entered through a hole in the roof. Visiting neighbours was also done via the roofs and therefore no streets were formed. The upper covers of the houses are comprised of a flat system. Various plants and wooden parts were placed between the wooden beams that were attached to the walls. This flat top cover system was formed by the compaction of the soil that was laid on this framework.



Figure 3. Çatalhöyük settlement

We observe from archaeological excavations that the adobe was used in Hittite civilization also. The capital of the Hittite civilization is Hattusa (or Bogazköy) and it is 82 km away from Çorum province. It is estimated to be the first capital city of Anatolia.



Picture 3. Archaeological excavations and restored house in Çatalhöyük

"Hattusa is believed to have been a residential area since 3000 years ago B.C. The city was first identified by the French historian, architect and archaeologist Charles Texier. The city's name Hattuşaş was confirmed in the excavations that took place between the years of 1907-1912. After the establishment of the Turkish Republic, the first archaeological excavations were done in Alacahöyük also, with the guidance of Mustafa Kemal Atatürk. During the excavations, the archaeologists discovered at least 5 layers of cultures in the pavilions that were built in the city: Hattian, Assyrian, Hittite, Phrygian, Galati, Roman and Byzantine."...

The city was divided into two parts, the Upper and the Lower Town. It spreaded around about 1 to 2 square kilometers on a hillside. While the Lower Town was occupied by houses, the Upper Town had temples. It is estimated that 40 to 50 thousand people lived in the city of Hattusa.

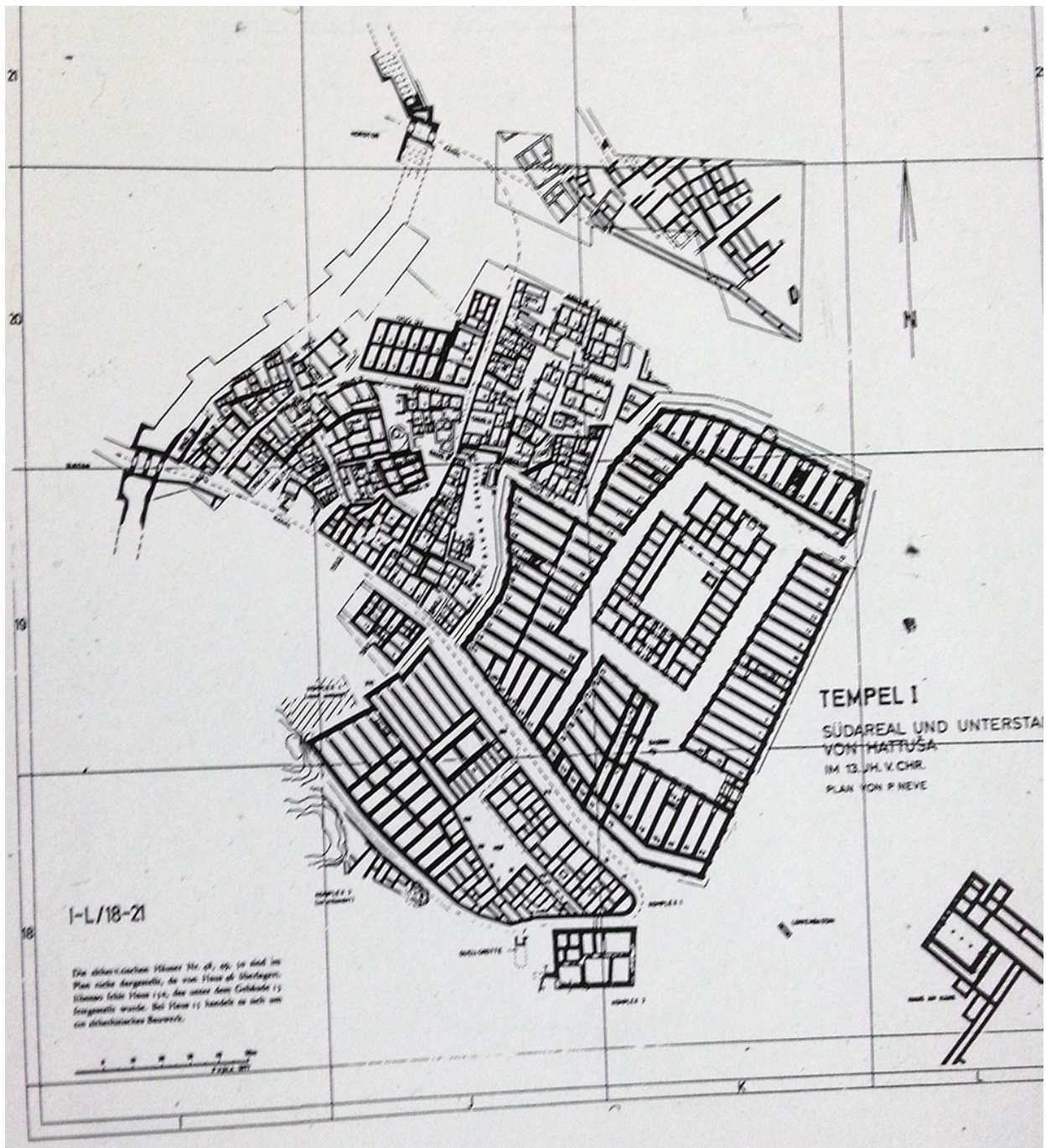


Figure 4. The capital of the Hittite civilization Hattusas City Plan

They used stone and adobe very heavily in the buildings that they built, however, in Hattuşaş, only adobe was used (unlike in Çatalhöyük) as the filling material. They built their Hittite cities inside ramparts (or city walls). These ramparts were made by placing one adobe brick after another onto a foundation of stone wall.

“city walls shaped coffer wall systems, consisted of side by side places behind the a twin walls, regular intervals on the outside of the tower with ledges between the outer wall of the tower and city gates that recurring at regular intervals” (ALP 2000)

The city center was reached via roads that led into the city gates. The ramparts of Karahöyük (another Hittite town near Konya) were also built in the above-mentioned method. Archaeological studies in Karahöyük show that the city had a rather ruly establishment plan.

The city consisted of streets that either intersected each other on town squares or ran parallel to each other. And houses that were built side to side, back to back on such roads. Most houses had two to four rooms. They were entered via a street door and a courtyard. The access from the front door to the rooms was made possible via wooden doors. The walls of the houses were built with adobe bricks that were laid side by side and on top of each other on a stone foundation that was sometimes in one and sometimes in two rows. Between the stone foundation and the adobe structure, wooden girders were used that extended horizontally and lengthwise. Muddy soil mix was used between the stone foundation and the adobe wall. They used the muddy soil mix between the adobe bricks also. The walls were plastered with muddy soil mix as well. just as in Alacahöyük. Their surface was plastered by white soil or lime also. These white walls were sometimes enlivened in-places by the making of different shapes. In these houses, window openings were observed rather rarely.

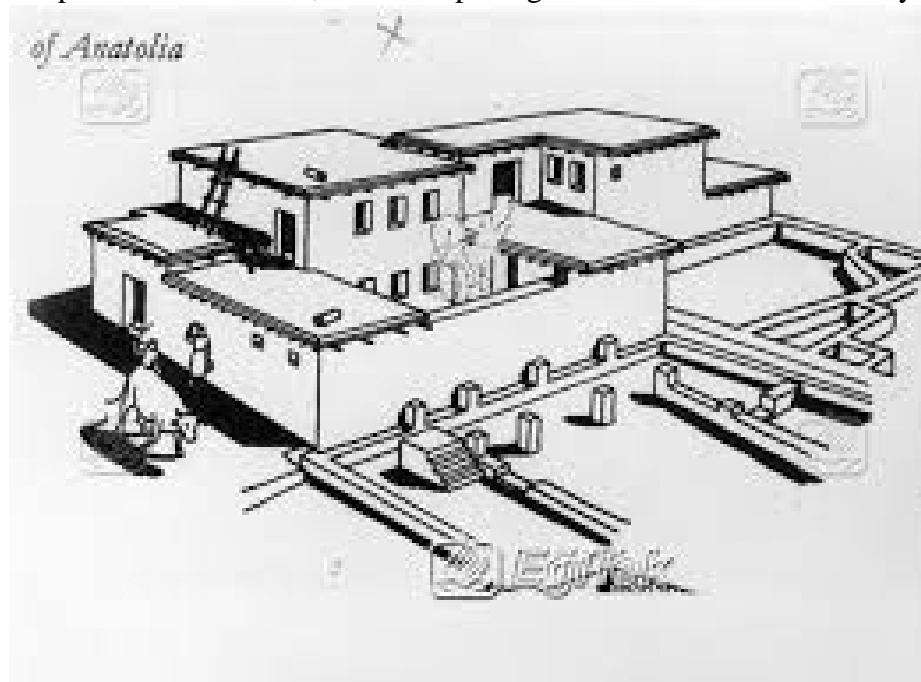


Figure 5. Hittite House

The development of Anatolian type of construction goes back 10 or 12 thousand years ago. And today, in certain areas of Anatolia, houses are still being built with the same principles.

"The idea of lifting the Anatolian house from the ground (to provide air ventilation from the bottom and thus to protect it from moisture) began in those days. The walls of the houses consisted of wattle-and-daubed timber frames covered with adobe and clay." (BEKTAŞ 2013)

Traditional Anatolian houses are the best examples of building settlements in accordance with the nature –not against it– and of a great cultural diversity and contentment with only what's available in the nature.

The Use Of Adobe In The Traditional Houses Of Anatolia:

"Traditions –especially in architectural styles– don't occur even in several centuries." (BEKTAŞ 2013)

Traditional houses in Anatolia are mostly integrated with the streets. They were formed according to many factors such as the local climate, the traditional structure, the historical and cultural heritage and the available material. They are compatible with the nature, frugal, unpretentious and yet serve to many purposes.

All across Anatolia, adobe was used very widely as a building material. It is a powerful insulator against cold and heat. It balances the inside moisture. If well protected, it is resistant to rain. And much more resistant to fire.

Today, it is possible to see the artistic examples of these houses in areas such as Balaban Malatya, Konya Şükran village and Harran. The famous Turkish architect Cengiz Bektas defines the adobe house as follows:

"The soil arises from the ground, becomes the walls that create the roof and again returns to its horizontal position. This texture is sculptural."

In the East, the Southeast and the Central Anatolia, the use of adobe in structures is very common. Adobe was usually used in the braiding of the divider members (the walls). In these regions, the use of soil and soil derivatives is closely related to the local climate and nature. Due to the continental climate and the lack of tree species, the production of adobe became mandatory.

It is possible to examine the use of adobe in structural systems in two main groups.

Massive Adobe Structure Systems with...

- ***Adobe blocks***
- ***Wrought adobe***
- ***Built-up adobe***
- ***Hybrid adobe***

Light Adobe Structure Systems with...

- ***Filled adobe blocks***
- ***Cast Adobe Filled" (ÇELEBİ 2012)***

Adobe blocks in the group of Massive Adobe Structure Systems are used on carrier walls only. These walls are woven by the bonding of adobe bricks with the adobe mortar. The stone foundation is started from the level of the water and the soubassement, then built up to a certain height and then connected to each other with wooden girders. Wrought adobe construction system is used for vineyard houses and garden walls.

Built-up adobe bricks are not suitable for building residential structures. They are used where there are no other possibilities are available, and in the construction of simple garden walls and levees, and in the hybrid adobe construction system, and in the emergency situations and repairs. (ÇELEBİ 2012)

The light adobe construction systems (as in the second group) are found in many parts of Anatolia. Adobe is used as a filling material in wooden skeleton systems. It is possible to name this system as adobe block filling. On the other hand, in the cast adobe filling;

"The gaps in the carcasses are attached to vertical wooden members that are connected from the top and the bottom. Then, among these members, cages that are in the horizontal direction are built by use of wattles. Finally, The gaps in the carcasses (with a cage on one surface) are filled by pouring-in adobe." (Celebi 2012)

The use of adobe in structures will be examined in two sample regions.

1. Eastern Anatolia Region, Balaban village of Malatya Province:

Balaban is a member of the Historic Villages Association. It's construction is made entirely of adobe. It was established on a small hill and consists of 1 to 2 storey contiguous adobe structures that are completely organic. The upper covers are completely composed of soil and flat roofs. These flat surfaces are ideal for summer hang-outs and for drying fruit and vegetables. Between two houses, there are crossovers that are completely free of the ground floor. These complex, organic houses are blocked by dead-ends in many places. They have

access to each other via interconnecting doors and crossovers on the ground floor also.

Therefore, it is possible to walk around the entire building without ever exiting the street. The ground floors of the houses are used for food storage while the upper floors serve as living spaces which consist of rooms lined up around a sofa. Each room is equipped to serve a family's multiple needs. The common toilet and bathing places are in another area.

Every room is suitable for sleeping, hanging out, heating, cooking, eating and storage.



Picture 4. Adobe structures in Balaban (Ref:<http://www.aklimbaskayerde.com/2010/iklim-degistikce-eriyen-kerpic-kent-balaban>)





Picture 5. Adobe structures in Balaban (Ref:<http://www.aklimbaskayerde.com/2010/iklim-degistikce-eriyen-kerpic-kent-balaban>)

Southeastern Anatolia Region, Akçakale District of Urfa Province

You can see the conical shaped domed adobe homes in Urfa Urfa Akçakale on Birecik way. They are all made of adobe and their roofs are plastered with soil. The inside height is 5 meters. The history of conical shaped domed adobe homes goes back to 6000 B.C. Domed house tradition continued up to 3000 B.C. around Mesopotamia, the Aegean region and the Trans-Caucasus. However they stil continue their existence today in the boundaries of South Eastern Anatolia, in Urfa. Conical shaped domed houses in Harran were also made with the same technique used in Akçakale homes. However, tile bricks were used instead of adobe.

And they were stacked with the overlaying technique. The adobe houses can remain rather cool in the summer and stay quite warm in the winter. They consist of domed rooms that are stacked side by side.



Picture 6. Conical shaped adobe structures in Akçakale (Ref. http://www.panoramio.com/photo_explorer#view=photo&position=5258&with_photo_id=74065596&order=date_desc&user=709943)

Conclusion

In the context of the basic principles of the ecological architecture, it is becoming increasingly important in our age to use structural materials that are friendly to the nature and also integrated with the environment. It has become necessary to design structures by taking into consideration many factors such as the underground and above-ground energy sources, the nature and the topography. Under the status quo, especially in the conditions of our country, we see that many lives are taken by structures that are built without the consideration of the increasing population, unplanned urbanization, environmental conditions, the climate, the topography. For example, the increasing floods that took place in recent years are all a result of our incompatibility with the nature. However; the areas where the first civilizations flourished are Mesopotamia and Anatolia. Structures in these areas are the best examples for ecological settlements in terms of material selection, human-space relations, sturdiness, aesthetics, nature-space relationship and settlement texture..

The fact that the traditional structures should remain friendly with the environment is explained by the famous architect Cengiz Bektas as follows:

"The mankind who created the House does not see all other creatures and everything in the universe as an environment created for himself. He does sees himself as one of the other creatures and as someone who exists with them at the sametime."

This insight emphasizes that the world of architecture should make its designs based on the universal oneness.

To integrate with nature, we need and should use natural building materials. The aim of this study is to show that adobe (as one of the best natural material supplies) should be strengthened under the current technical conditions and resources and be used again in today's architecture. Why adobe?

- Produced from soil which is readily available in nature.
- Economical.
- It is a good insulator against heat and cold.
- Balances moisture.
- Does not pollute the environment
- Compatible with the environment
- Provides natural air circulation
- It is more economical than wood and stone

It is possible to build contemporary settlements with the re-use of traditional and local ingredients and without the need for high technology. We can still make living spaces that are comfortable, at peace with the nature, handy, easy to live in, aesthetic, robust and suitable for human health.

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