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TIMBER CONSTRUCTION SYSTEMS IN ANATOLIAN VERNACULAR ARCHITECTURE

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Abstract: *Timber, along with stone and mudbrick, is among the most widely used building materials in architecture. Since the beginnings of architecture, timber has been a building material that has been employed in every type of wooden structure. In Anatolian architecture as well, timber was used throughout history, from the Neolithic Age onward. It can be seen that wood was a prominent element of particularly vernacular architecture beginning in that era. In every region of Anatolia, varying geographical and climatic conditions, as well as characteristic materials and sociocultural trends have produced natural habitats that display different traditions of building. These regional differences have resulted in architectural identities that are specific to each area. The regional houses built from the indigenous types of timber found in an area encompass the building systems of that location, thus assuming a regional identity. The aim of this article is to present the timber building systems used in traditional Anatolian vernacular architecture in an attempt to uncover the architectural wealth that this traditional system of building embodies.*

Keywords: *Traditional Timber Houses, Timber Construction, Timber Identity*.

1. Introduction

Different geographies and cultures throughout history have developed a vernacular culture of building that carries all of the physical and social characteristics of that region and culture. Traditional residential architecture adapts to the particular region's geographical andtopographical conditions, to environmental factors such as the region's vegetation and local materials, as well as

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to underlying social aspects. Environmental factors play a major role in shaping the forms of traditional houses. Physical and environmental elements are basic to a structure's position, orientation, choice of materials, layout, construction materials, and the design of its facades.

In every region of Anatolia, varying geographical and climatic conditions, as well as characteristic materials and sociocultural trends have produced natural habitats that display different traditions of building. These regional differences have resulted in architectural identities that are specific to each area.

Timber is among the most widely used construction materials in traditional Anatolian residential architecture. Even when every type of building material was available in a particular region, wood has been used in Anatolian houses ever since the early Neolithic Age due to the advantages presented by its ease of application, its light weight and capability to accommodate ornamental designs. Starting from this period, it was seen that horizontal wooden beams were commonly used as a connecting element to reinforce walls of mudbrick or stone, to make them more endurable against the horizontal forces of earthquakes, and to prevent potential vertical cracks in the structures. In many settlements of Anatolia, timber was employed to reinforce mudbrick or stone wall bondings and make them more endurable, to strengthen walls and increase their resistance to distortion.

Many different timber construction techniques can be seen in the traditional vernacular architecture of today's Anatolia. These regional houses, built fromthe indigenous types of timber found in the area, also embody building systems specific to their locations, assuming a regional identity. The aim of this article is to present the timber building systems used in traditional Anatolian vernacular architecture in an attempt to uncover the architectural wealth that this traditional system of building embodies.

2. Timber Construction Systems in Anatolian Vernacular Architecture

In every region of Anatolia, varying geographical and climatic conditions, as well as characteristic materials and sociocultural trends have produced natural habitats that display different traditions of building. The oldest type of material to be used in traditional Anatolian houses is wood;construction techniques using wood tended to develop in areas of Anatolia where trees were abundant.

The qualities of being easy to handle, earthquake-resistant, and conducive to rapid construction encourage the use of wood as a building material. The parts of Anatolia where forests are most extensive are the regions of the Black Sea, Western Anatolia, and the Taurus Mountains. Central and Southeastern Anatolia are unwooded areas. The types of timber used in traditional Anatolian residential architecture vary from region to region, but in general the trees used in building can be cited as juniper, willow, poplar, fir, white pine, oak, yellow pine, cedar, chestnut, and ash. Walnut, boxwood, applewood, ebony, and oak are used in the woodwork of doors and windows [9]. The reason these types of trees are preferred lies in their durability in climatic conditions such as rain and humidity, their endurance, their resistance to fire, their hard and robust properties, and the fact

that they donot provide a friendly environment for worms and fungi.

The timber-based construction systems used in traditional Anatolian vernacular architecture can be divided into the three main categories of "wood masonry," "timber framework",and the "timber-supported stone masonry wall".

2.1. Wood Masonry System

The first of these systems, wood masonry, consists in placing timber planks, logs or stumps 2-5 cm thick one on top of another. Sometimes, these planks or logs are plastered with mud on their inner and outer surfaces. The houses built using this system do not have a foundation; the logs or planks are set directly into compacted earth. In this technique, vertical rods are not used, but the wooden pieces are laid one on top of another upon the earth up until the level of the basement, having been cut and shaped into planks with a saw or left as logs. These pieces are fixed together with joinery methods that are known as *kurt boğazı (wolf's neck), kara boğaz* (black neck), *kertme boğaz (notched neck)* or *çalma boğaz* (Figure 1) [14]. The wooden materials in the system, whether logs or planks, have taken on the functions of being both loadbearing and protective against the elements [13]. The wooden masonry system is generally known as "*Çantı* technique" (log walls) or the "*Anatolian Wood-filled System*", and as "*Taraba"* in some areas of the Black Sea region. It is widely used in the Western Black Sea region of Anatolia, in the Northwestern Anatolia cities of Adapazarı, Sakarya, Sapanca, Düzce, Bolu, Gerede, Göynük, Ağva, and Sinop, as well as in Rize and Artvin in the region of the Eastern Black Sea. Buildings built usingthis technique are called the vernacular *taraba* or *daraba* in Trabzon and areas to the east. The inner and outer walls are woven together in this system. No nails are used and the pieces of wood are set one on top of another, leaving an overlap of 20-30 cm from their joining points. Since all of the loadbearers are horizontal, vertical elements need to be placed only on the edges of windows and doors [14]. These houses are covered with gabled roofs, slanted on both sides. It is reported that in early examples, the roof covering was shaped in the form of *hartama* (a piece of timber cut with an axe in the form of a thin plank for the purpose of covering the roof [18]). Sometimes in this system, the ground floor of the buildings isbuilt with coarse logs while planks are used in the upper floors. This type of construction scheme in which two types of system have been used is referred to as a "mixed system."

The roots of this system, in which the wooden construction materials are placed on top of each other with various joinery techniques without using any vertical loadbearing element, go back to Anatolia's Late Chalcolithic Age. The settlements of İkiztepe, Horoztepe, and Dündartepe display evidence of buildings built in the oldest examples of the çantı technique used in Anatolia [11]. In one of these settlements, at Bafra İkiztepe, the walls of the structures are made up of logs that have been placed horizontally one on top of another. These logs are elevated by attaching them to each other at the corners with various *"boğaz geçme"* joinery techniques. All of the houses in these settlements are fromwood, in the *çantı* system. Besides logs, other forms of timber planks have also been used. The walls that form when these planks are

bonded together tightly are sometimes plastered with mud, but they are generally left untouched [7].

The *çantı houses* that are some of the most unique types of houses in northwestern Anatolia are not actually large and many-roomed, but are more likely to be simple two-roomed dwellings. The houses can be built in two-story form and in this case, the ground floors house the barn, the hayloft, and a warehouse or storage space. In the center of the upper floor, which is the main living space, is what is called a *çantı room*. If there are other spaces such as an ablution area and bathroom, the other rooms have been arranged around this central unit [10]. If necessary, these structures can be dismantled and rebuilt at some other location.

Fig. 1.

Left: *An example of a çantı house made from trimmed planks. Köprübaşı Village. Kurt Boğazı joinery technique has been used in the corners. Çamlıhenşin, Rize.*

Right: *An example of a çantı house made from logs. Kara Boğaz joinery technique has been used in the corners. Şavşat Artvin [6]*

Outside of Anatolian houses, the *çantı system* has also been used in hay lofts and warehouses, as well as in mountain houses. Another group of structures that makes use of this system is the mosques. Especially in the Early Ottoman Era, under the rule of Orhan Gazi, and in the period of the Seljuks, this group was called "*çantı* mosques" and they are striking for their rich interior decoration embellished with hand carvings [4].

2.2.Timber Frame System

The second type of timber construction system used in the traditional residential architecture of Anatolia is the "timber frame system." This is also known as the "*çatma"* or *"çatkı"* system. It is characterized by the use of vertical elements/posts, bases, tie beams and buttresses (*göğüsleme*), and other elements of timber [2]. The system consists of vertical timber posts and

beams that transfer the structure's load to the ground, and is characterized by its ease of installation, its capability of producing multi-story buildings and facilitating the implementation of various architectural solutions. The houses usually rise above an elevated ground floor. The ground floor or sub-basement is generally with or without beams and built of dry-rubble or plaster-filled masonry or mudbrick, while the upper floors are constructed using a wooden frame system.

The timber frame system is described below;it is the most widely used building system–with some differences–seen in Anatolian residential architecture. The foundation or ground floor is first filled with what is called a *"lower base"* of timber. This lower base is made up of two pieces so that it is rendered rigid, and additions may be made. Then vertical construction elements *(dikme)* are laid at defined intervals on top of the lower and upper base, delineating the height of the floors of the house. The poles that are loadbearing are called the main posts, those at the corners are named corner posts.The posts cut into smaller pieces that are in-between are called *ara dikme*, or intermediate poles (Figures 2 and 3).

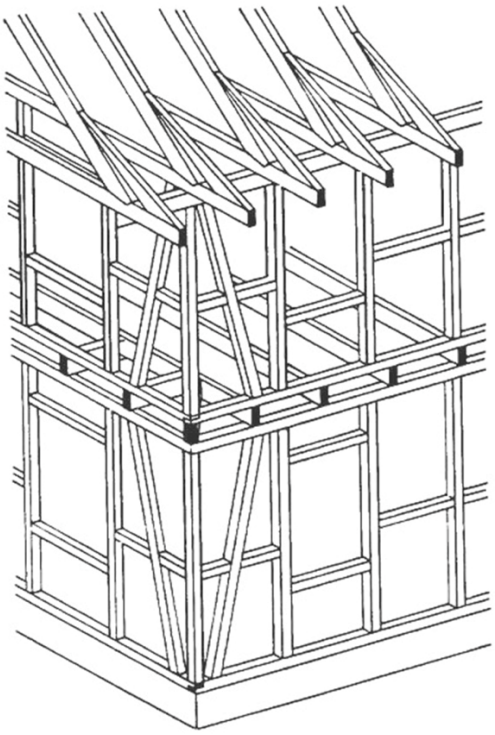

Fig. 2. *The most commonly used timber frame construction system used in traditional Anatolian vernacular architecture [21]*

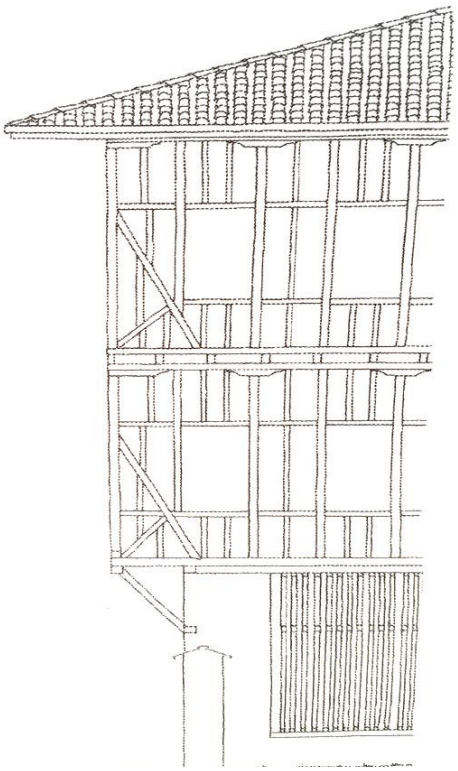

Fig. 3. *Anothertimber frame construction system in traditional Anatolian vernacular architecture*

The "upper base" consists of horizontal timber seamlessly joined together and laid out as in the lower base, but rising up at the corners and between the main poles. The çatkı frame has another element, the buttress (*göğüsleme*, *yanlama, tırnak*), which is laid out diagonally in between the posts belonging to the lower and upper bases [2]. The function of these buttresses is to serve as stabilizer between the lower and upper bases in the face of the horizontal loads brought about by an earthquake. To increase the stability of the walls, elements known as *"boyunduruk"* or yokes are placed horizontally between the posts and the buttresses [20]. This system of closely standing posts allows for all the horizontal and vertical loads to be transferred to the foundation via the timber components. The system has been implemented in all kinds of houses in the same way–from houses to mansions and large shorefront homes.

The cavities formed by the timber frame are filled with any one of four?different materials (brick, stone, mudbrick, and timber) depending on what materials are to be found in the region. The name of the system thus changes based on the type of filling used. The first of these filling systems is the brick-filled timber-frame system. The timber *"çatkı"* filling consists of brick. The bricks are generally grouted bricks stacked in vertical piles (Figure 4). Although the pattern changes from structure to structure, the motifs of the stacks of bricks are seen to vary from the *"çatal"* or forked motif, the diagonal stack, the two-way diagonal stack, a stepladder motif to motifs reminiscent of cypress trees and a sunbird [18]. The grout used between these decorative bricks isof white lime plaster. Brick-filled walls are usually plastered only on the interior. Brick filling can be found in the majority of regions in Anatolia. Ottoman houses dating back to the second half of the seventeenth century are the earliest examples of the use of brick infilling. Particularly among the houses in the environs of Bursa and Mudanya, the most famous is the Bursa Muradiye Residence which todayis used as an Ottoman Museum. Known as Istanbul's oldest house, the Kafevyan Residence, dated to 1751, is one of the oldest timber frame houses that has been infilled with brick.

Fig. 4. *The timber frame brick infilled system. Bursa, Derekızık Village (Author)*

The other type of infilling system is known as *hımış*, which is a timber frame system infilled with mudbrick (kerpiç). This system is called *yegdane* in Safranbolu [18]. *Mudbrick* has been used in Anatolia ever since the early Neolithic Age. Used in the majority of regions in Anatolia, especially in Central Anatolia, mudbrick (*kerpiç*)is an infilling material of preference due to its easy and inexpensive availability and its capacity for heat insulation.

The timber that comprises the framework of the structure in this system is supported by main and intermediate

posts on the vertical and by a beam system connected at intervals on the horizontal. The spaces in the timber system are adjusted according to the dimensions of the mudbrick(*kerpiç*) (Figure 5). The mudbrick allows the spaces between the posts to expand [19].

Fig. 5. *Mudbrick-filled (kerpiç) timber frame system. Cumalıkızık (Author)*

The dimensions of the mudbrick vary according to region. Mudbrick (*kerpiç*) has been used in this frame system horizontally, diagonally or in combined fashion. The mudbrick (*kerpiç*) infilling consists of the internal and external surface walls in the timber-frame system being plastered or sometimes whitewashed over the *bağdadi* timber-work. In this system, the space between the loadbearing timber posts is sometimes filled in with mudbrick (*kerpiç*),sometimes with stone. In this case, a mixed system characterizes the structure. One of the most well-known of this type is the Çakırağa Konak in Birgi, dating to the second half of the 18th century.

Another infilling material used in the timber-frame system is stone. Stone is generally preferred when it is more readily available than either mudbrick or brick. The stone-infilled timber-frame system in Anatolia has been used more widely in the areas of Kula, Birgi, Safranbolu, and the Eastern Black Sea region. In Kula, the houses in the area were built from andesite, basalt, küfeki (limestone, a type of tuff formed from lava), sphalerite, and slate, which are rock formations created as a result of volcanic eruptions [8]. Birgi houses were built with stones unique to the Aegean Region that were available in different types and dimensions (Figure 6). However, slate (*kayrak taşı*) was the most commonly-used type. The building material used in Safranbolu was limestone and "*küfünk taşı",* local stones found in the caves in the region that were cut up with saws in the dimensions of brick [18].

The stone infilled timber-frame wall system (*çatma*) is prominent in the region of the Eastern Black Sea, where various wall joining techniques have been used in an area that has the most expansive and lush forests in the country. The vast forests that the geography offers in the Eastern Black Sea region provided locals with ease of access to indigenous materials, thereby creating an opportunity for the development of timber-building techniques in the area. The rugged and uneven terrain and a climate of abundant precipitation have been major determinants in the evolution of the architecture and the configuration of

settlements in the area. An important outcome of the plentiful rains is the vast forest area that constitutes the main source of construction materials. The cover of vegetation in the region, running down to the coast, is made up of alder, pine, chestnut, beech, walnut, linden, and acacia trees. Among these types of trees, the chestnut is particularly common as a building material in traditional architecture due to its high resistance to fire and insects, and the ease with which it can be worked. The walnut tree is mostly used in furniture and cabinet-making. It can also be seen that pine is mostly used for the interior sections of buildings [15]. The stone-infilling techniques seen in the timber-frame system used in the region of the Eastern Black Sea can be divided into three groups;*göz dolma* (cell-filled/stuffed walls), *muskalı dolma* (triangular amulet), and *çakatura* (lathwork wall / *Bağdadi* wall).

Fig. 6. *Stone infilled timber-frame system. Kula (Author)*

Fig. 7. *Cell-filled/stuffed wall system [6]*

The first of these stone-working techniques, the *göz dolma* (cell-filled/stuffed walls) system, entails fixing wooden vertical posts of approximately 8x8 or 10x10 at 15-25 cm intervals onto the beam forming the base of the frame. The spaces in between the timber posts are distributed in equal intervals using horizontal pieces of wood 3-5cm thick. These pieces of wood are interlaced and fixed into the spaces between the posts at 20-30 cm intervals. This creates rectangular *"göz"* or cells on a vertical and horizontal plane [15]. These rectangular *"göz"* or cells are filled with clay and a single rock or many small stones that are used as fasteners (Figure 7) [22]. Once the stones are set in, the remaining spaces are filled either with clay or lime mortar, and bağdadi plaster or wood sheathing is used in the interior. The infilled cells are joined on the walls using timber joinery techniques. Then the walls are plastered and whitewashed with lime,according to preference.

Another stone-filled timber-frame (*çatma*) wall system observed in the region of the Eastern Black Sea is the triangular amulet system that takes its name from the traditional delicacy of*"muska" or "stuffed muska."* In this system, the vertical posts are divided into diagonal pieces of wood (buttresses) inclined at a 45 degree angle. Here, since

the posts have been divided diagonally, the cells take the form of triangles. The spaces between the posts are freer and more varied compared to the cell-filled system. Because of this, there are also differences in the dimensions of the triangular cells [15]. It is not only one smooth stone that is filled into the triangles formed on the surface of the walls, but small pieces of stone (Figure 8).

Fig. 8. *Houses built in the muska ortriangular amuletsystem [6]*

The triangular spaces are thus filled with pieces of stone in the exterior, as in the cell-filled system, but in the interior the work is completed with a filling of clay or grouted with lime mortar. In the *muska or* triangular infilling system, nails and other metal fasteners are used in the joinery [18]. Traditional houses built with triangular or cell infilling have a characteristic appearance that stems from the construction system used in the structure.

Another type of stone infilling that is used in the walls of the timber-frame (*çatma*) houses of the Eastern Black Sea region is called *çatakura (Lathwork wall/Bağdadi* wall). In terms of installation and structure, the *çakatura* system displays all of the features of the *triangular amulet* system, the difference being that the surfaces of the outer walls are plastered with or without using *Bağdadi* laths [14]. This system, known in the region as *Bağdadi,* displays examples in which the interior and exterior faces of the*Bağdadi* walls have wood sheathing [5]. *The çakatura* system is a construction system that appears in the Eastern Black Sea region less commonly compared to the *cell* or triangular amuletinfilling systems, except in two villages in Artvin [6]. Houses built in the “mixed system” using two different kinds of construction technique can also be found. This generally stems from the materials that the builders had on hand at the time of construction.

Another infilling material used in the timber-frame system is wood. In the wood-infilled system, the sections between the horizontaland the vertical wooden building elements are closed off again with pieces of wood. Traditional Anatolian residential architecture features two kinds of wood infilling (*dizeme* meshing, netting) and basketweaving techniques [5]. The first of these, *dizeme* infilling, involves filling up the wooden framework usually with pieces of wood that are perhaps remnants of wrecked houses, placing them vertically or horizontally in the spaces together with pieces of wood or wooden beams (Figure 9). This construction technology, sometimes entailing the use of wooden nails to fix the pieces to each other, is peculiar to the regions of Northwestern Anatolia and the Black Sea. The particular areas where unique examples of this system can be seen are Şile, Kandıra,

Safranbolu, Seben, Göynük, Gölcük, and Mudanya.

Fig. 9. *Dizeme infilling in the timber framework (çatkı) system. Mudurnu (Cultural Portal, Mudurnu Bolu)*

Another timber infilling type used in the timber framework system is *"basketweave infilling."* Basketweave infilling is unique to Thrace, Northwestern Anatolia, and the Black Sea, and the timber generally used in these regions for this technique is the chestnut tree. The infilling is carried out by inserting thin sticks of wood vertically so as to join the main posts at the corners. Then the chestnut branches are woven through the sticks in a basketweaving fashion. Sometimes the branches are not woven through the main posts and sometimes they are placed in a cavity opening out into the main post (Figure 10). The lattice weave is covered on both surfaces with a mixture of mud and hay. Ultimately, the spaces between the structural wooden components become functional, yielding an earth-infilled wall system. The inner walls and the inside of the outer wall in the timber framework system as well as the wooden structural components are covered with an earth-based plaster, while the outer side of the external wall is covered with wood. This kind of system is characteristic for being a finer, more flexible and lightweight construction scheme, reducing the risk of damage from earthquake loads. The system also carries the advantages of thermal performance and increased sound insulation.

Fig. 10. *Basketweave-filled timber framework system. Detail. Şile Akçakese Village (Author)*

The main and auxiliary posts in this wall system have intervals of 40-60 cm between them; an even-shaped branch with a diameter of 3-5 m is inserted between the posts (Figure 11).

Fig. 11. *Basketweave-filled timber framework system. Şile Akçakese Village (Author)*

Branches of the same diameter cut in half are hammered into the inward-looking surfaces of the posts on either side. Then thinner twigs with diameters of 2-3 cm are inserted through one side of the half-round branch on one post and guided through the opposite side of the branch in the middle, finally being tied to both sides of the half-round branch on the other post. A second branch is guided in the opposite direction 1.5-2 cm above the former branch, thus achieving a basketweave or lattice pattern.Both sides of this weave are plastered with mud and then with lime plaster, and finished off with whitewash [18]. This system is also called *çöten* in the Black Sea region and is actually the *wattle and daub* architecture technique of usingbranches, latticework, and mud mortar, or the technique of *dal-örgü çamur-harç.* This construction technique is known in the Balkans as well and it has been observed since the early stages of the Neolithic Age in Anatolia [16].

Fig. 11. *Basketweave-filled timber framework system. Şile Akçakese Village (Author)*

If plaster is to be used in structures of timber framework, the plaster is applied on what is called *Bağdadi* strips at certain intervals on the face of the framework of the wall. These strips are usually placed at close intervals in Anatolia. This is called *Bursa type Bağdadi* (Figure 12).

Fig. 12. *Bursa type Bağdadi. Mudanya (Author)*

In Antalya and its environs however, the *Bağdadi* strips are driven in more widely apart; this is called *Antalya type Bağdadi* (Figure 13). In the Bursa type of Bağdadi, the strips are hammered in from the inside and the outside at 1.5-2 cm intervals while in the Antalya type, the strips are more like slats, driven in at intervals of 4-7 cm [18]. This kind of plaster is called *bağdad* plaster. When plaster is applied to *Bağdadi*, the plaster oozes back into the spaces, holding the plaster like claws. The plaster preferred in Anatolian residential architecture is lime mortar. This plastered wall system or lathwork wall/*Bağdadi* Wall system has the added advantage of protecting the

structure from the elements. The lattice formed by the laths in the *Bağdadi* system also has the important function of providing structural durability in case of earthquake. Since each *bağdadi* lath is driven into the posts with nails, this forms elastic joinings that resist earthquake forces, with the nails stretching to lessen the energy in more forceful earthquakes [12].

Fig. 13. *Antalya type Bağdadi (Author)*

Sometimes a *Bağdadi* wall is built by driving thin strips into both sides of the framework in the case of walls with an empty carcass. This method has been widely used, especially since the nineteenth century. The *Bağdadi* wall technique involves hammering wooden strips (called *bağdadi strips)* into the two sides of the timber framework and then plastering this with what is called *Bağdadi* plaster.

2.3. Timber-Supported Wood Masonry Stone Wall System

The system of timber-supported (beam) stone masonry or mudbrick walls is one of the oldest wall building techniques used in Anatolian residential architecture since the Neolithic Age. The method of using horizontal wooden beams as a connecting element between rows of mudbrick or stone to make both the walls and the building more endurable against the horizontal forces of earthquakes is still employed today in the building of traditional Anatolian houses (Figure 14).

Fig. 14. *Use of a wooden beam on a stone wall (Author)*

The wall building technique of timber-supported stone masonry used in today's traditional Anatolian residential architecture can be seen in what is known as the "button houses" of the Mediterranean region, in the areas of Ormana and Akseki-İbradi in Antalya. The traditional construction system peculiar to this region has been named in the local vernacular *"pıştuvanlı"* or "wall with beams." "Püştiban/Püştivan" is derived from Persian and means foundation, support, buttress or assistant [10]. The term is used for the tie-beams that are used to join beams together. The tie-beams are also referred to as *düğme*, meaning "button" in Turkish. Buildings constructed with this technique, where dry walls are reinforced with wooden beams without mortar, were taken into UNESCO's list of World Heritage Site candidates in 1994. The areas located in the Taurus Mountains are characterized by an extremely rough climate and lush

forests. Cedar, pine, turpentine trees, spruce, juniper, oak, and elms are abundant [10].

The "Button Houses" are generally made of cedar and their stone masonry consists of irregular rubblestone, intermeshed with no mortar used. Reinforcement is provided every 50-60 cm height-wise, and a pair of timber beams (*hatıl*) are aligned with the walls on either side. The beams are joined by tie-beams (*peştivan*) interspersed at 50-60 cm [17]. The rubble stone masonry is reinforced with the insertion of rows of runner-beams (*hatıl*)at regular intervals, which are fixed in position with projecting cross-ties (*peştivan*) (Figure 15). When the stone masonry reaches a height of approximately 50-60 cm, the builder introduces a new series of runner beams connected to the *peştivan.* The *peştivan* projects 25 cm from the wall [17]. This technique of using "timber-reinforced rubble stone masonry with projecting tie-beams" creates a paten on the facade of the structure (Figures 16 and 17).

Fig. 15. *Example of a Button Wall (Author)*

Fig. 16. *İbradi Button House (Author)*

Fig. 17. *Traditional "Button House" Construction Process [17]*

3. Timber Sheathing

In some regions, the timber framework system is covered with wood. This technique is seen particularly in Istanbul, where the structures are covered with wooden material to provide protection from climatic conditions. It can be seen that pitchpine has generally been used to

cover the facades of Istanbul's wooden buildings. The wooden material used in covering facades is 1.5-2.5 cm thick and 20-35 cm high. Sometimes wood sheathing has been applied to a *Bağdadi*-plastered wall and sometimes directly on the timber framework [3]. The wood is applied to the timber framework either horizontally or vertically. The vertical sheathing is either *ribbed* or in the form of what is called *yalı baskısı.The ribbed* form is the most popular type of wood sheathing in Istanbul. In the *ribbed* sheathing, the laths are driven into the side of their wooden surfaces so that they are parallel to the faces of the framework (Figure 18).

Fig. 18. *Ribbed Wood Sheathing used in a timber framework system, Istanbul (Author)*

In *yalı baskısı* sheathing, the top row of the sheathing is made to overlap 3-4 cm over the lower sheathing at a small angle.The wooden sheathing is hammered into the slats and the framework so that it juts out 2-3 cm on a small angle on the vertical plane. In this system, the wood is driven in starting from the bottom row with the upper row being nailed down so that it overlaps the one below by 3-4 cm (Figure 19). In *yalı baskısı* sheathing, the corners, the window frames, and the lower edges of the covering are finished off with sills or casings [18]. Because of its physical likeness to the wing of a turtledove (*üveyik*), this system is known as "*üveyik (eveyik)* wing" in some regions. The overlapping of the sheathing slats provides a water-resistant facade covering.In some rare cases, *yalı baskısı* is painted over at ground floor levels.

Fig. 19. *Yalı Baskısı sheathing on a timber framework system, Şile (Author)*

In another type of wooden sheathing applied to timber framework, the wood is laid out vertically. This system, where the wooden slaps are placed on the vertical, is only very seldom used compared to the horizontal system [1]. The most beautiful examples of this system can be seen in the Erzincan Kemaliye Eğin and Malatya Pütürge houses. The system consists in nailing equally wide sheathing slats onto the timber frame perpendicularly sothat they cover the base beam. This system has

varying applications depending upon the region, and it has also been used in Istanbul. In this handsome example I saw in the Köprülü Amcazade Hüseyin Paşa Waterside Mansion, the vertically placed sheathing surrounds the structure on all sides (Figure 20).

Fig. 20. *An example of vertical wood sheathing on timber framework. Köprülü Amcazade Hüseyin Paşa Waterside Mansion [18]*

4. Conclusions

Timber is a construction material that is very much preferred for a host of reasons in traditional residential architecture in Anatolia. Even if every type of building material is available in a particular region, wood is still used due to the advantages presented by its ease of application, its light weight and capability to accommodate ornamental designs.

Different types of timber construction techniques can be seen in all regions of Anatolia, which as a whole boasts of a rich culture of timber building. The centuries of knowledge and experience of this timber building culture can be witnessed in the traditional methods of construction still used today.The regional houses built fromthe indigenous types of timber found in each area embody building systems specific to their locations, assuming a regional identity. Constructed by regional master builders and based on traditions that have spanned thousands of years, the architectural examples of wooden houses in Anatolia call forus to do all that is possible to preserve the vernacular building techniques in order to protect the spirit of the region and pass it on to future generations.

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