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Landscaping for earth-sheltered housing: A study on mud-roofed houses in Anatolia

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Abstract:
Traditional mud roofs are still used in various parts of the World, especially in areas of low to medium rainfall. They are popular because of their low cost, ease of construction, and high resistance to heat penetration. Construction materials required to build such roofs are also readily available.

In mud-roof construction, landscaping can also be a critical element of the overall design, which must be coordinated with all of the other layers of the roof, particularly the structural and waterproofing system as well as soil and drainage system. Landscaping surely enhances the attractiveness of mud-roofed houses, but it should not be thought of as a separate decorative feature or supplementary element to be added after the house is built. It has a very important role in the success of waterproofing and insulation systems of the house.

This paper presents both the major landscape concerns, which are unique to this type of construction, and the existing practice of the most builders. During this presentation, some roof attempts for improving the structural, thermal and water resistance properties of the traditional mud-roof are also discussed. Based on this discussion, an improved mud-roof section is introduced.

Keywords: *Earth-sheltered housing, mud-roofed houses, landscaping, Anatolia.*

> *"From the earth We created you, into it We shall return you, and from it We shall raise you a second time" The Qur'an [20:55].*

1. Introduction

The concept of mud-roof found a place even in the first lines of the memorable story of İnce Memed, which tells the story of a poor and orphaned boy named İnce Memed living in Değirmenoluk village located in the magnificent Taurus Mountains of Anatolia. The meaning of mud-roof for Anatolian people attributed by Yaşar Kemal, can be dearly observed in his

expression about İnce Memed's escape from the pressure of Abdi Agha, unjust and despot master of the village (Kemal, 2005):

> *"…The boy stumbled and stopped. He felt dizzy and black spots were dancing before his eyes. The earth seemed to spin around him like a top. His hands and legs were trembling. After looking back a moment he began to run again. Once a flight of partridges rose suddenly nearby and startled him. Any sound scared him and his heart was beating very fast. Hopelessly he glanced back again, drenched in sweat. His knees gave way beneath him and he sank to the ground on a small stony slope. He could smell his own acrid sweat, but mingled with the pleasant scent of flowers. Though he could hardly open his eyes, he raised his head heavily, fearfully, and looked below, where he could barely distinguish a mud-roof. His joy was so great that his heart seemed to leap up into his mouth…"*

Who knows, Süleyman from Kesmeköy, the owner of the mud-roof house that makes İnce Memed feel like a child in a sweetshop, how hardly built that roof. Upon viewing this procedure, he made some poplars cut for the roof, and God knows how many days he had to spend before finding the right purlin used as central log (*hezen*). This painstaking care was performed because the *hezen* was the crucial part of the house construction. It is quite likely that after waiting for days, he found the *hezen* in another village. The *hezen* was the main girder, alongside a built-up mast and wooden rafters side by side (Figure 1). Surely, friends, brothers, relatives, kin and the succor did not come with empty-hands. Some of them brought straw, some brought branches to be spread over the roof and some with wood. Maybe the mud-roof was taking its community appeal from this collective work. Respectively, all rafters were laid down, twigs and reeds placed over, and the barren soil (*çorak*) mixed with straw was laid all over it (Figure 2 & 3). After completing reinforcement work with a stoneroller (*loğ taşı*), only the rainspout (*çörten*) was left for placement (Figure 4). Finally, He poured some water on the roof to test the slope and placed the *çörten* accordingly. Maybe

Figure 1. *Hezens (central logs) and wooden rafters.*

the sweet smile on his face was similar to the smile on İnce Memed's face at the time when he discovered the mud-roof.

There are thousands of houses with mud-roofs in Anatolia similar to those in Kesmeköy and Değirmenoluk. Therefore, many mud-roofed houses brought similar joys like the labors that İnce Memed or Süleyman experienced. That being said, many mud-roofed houses with contain a plethora of hidden stories and experiences alike.

Figure 2. *Twigs and reeds placed over the rafters.*

Figure 3. *Çorak (barren soil).*

In Anatolian culture, soil is a material that meets most of the essential needs of people from cradle to grave. Except the foods cultivated through soil, the soil has been utilized for centuries for needs of creating tools for cooking and storing, for cleaning purposes, for treatment and sheltering. Even though the amount of soil usage varies from time to time, according to the current politics and the natural conditions of region, this need never ceases to exist. For instance, never has there been a government after 1940s, which considered the houses with mud-roofs as a cultural or an architectural focus. All of them followed the idea that "Civilization cannot exist under a mud-roof. Concrete and brick will bring civilization to the East." However, despite this long lasting approach, Anatolian people kept on using soil as a means of an alternative construction material because of either cultural or climatic reasons. Still, soil as a material especially for roof cover can be widely observed in the Middle and Eastern parts of Anatolia.

Mud-roofed houses and other types of earth-sheltered housing can be found not only in Anatolia, but also in many other environments, climates and on many landforms. Actually, the use of earth-sheltered space for housing is a practice that is as old as civilization itself. Although it is associated with prehistoric times and the incidence of natural caves, the international creation of underground and earth covered structures have persisted throughout the world. Every age has provided remains proving the inclination of humans for digging in or covering the roof with earth. For a variety of reasons, people have lived in such structures. With simple mud and straw, the ancient Egyptians built complex dormitory-like structures. According to McConkey, it was because wood was more valuable, and they learned the value of using earth as a building material early on.

From the Japanese communities or Chinese dynasties in the Far East to the Indian civilizations of Far West, developed some form of earth-shelter construction (McConkey, 2011). For example, in Japan was discovered the

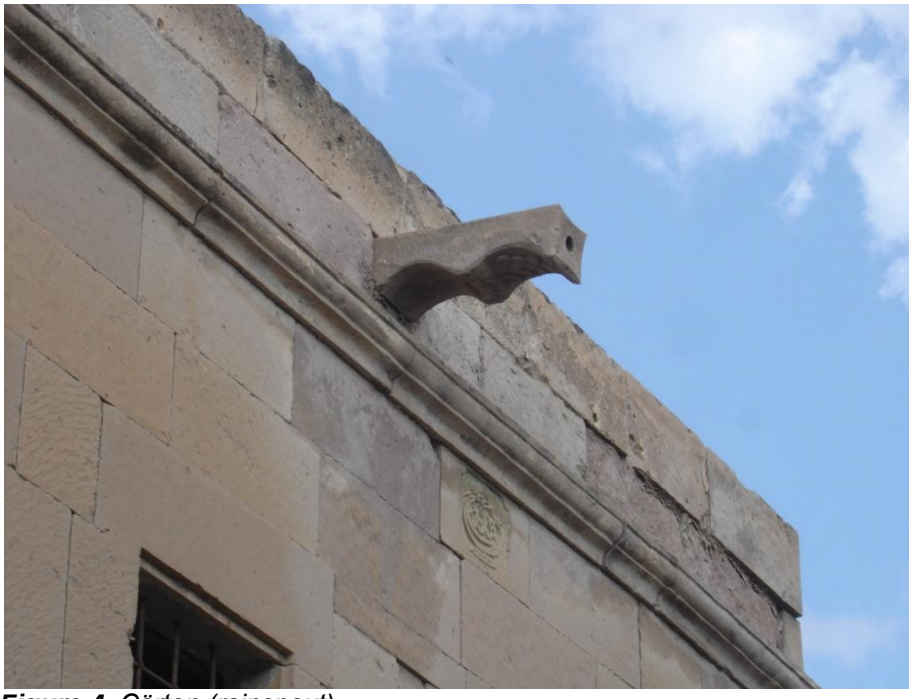

Figure 4. *Çörten (rainspout).*

oldest human habitation in a layer of earth about 600,000 years old in Kamitakamori, Miyagi Prefecture (Anselm, 2007). Perhaps the largest continuously occupied subterranean region in the world is in the northeastern provinces of China (Boyer & Grondzik, 2000). Especially, Yaodong underground dwellings are a particular form of earth shelter dwelling common in the Loess Plateau in China's North.

One of the most Far West examples is that provided by the ancestors of the Pueblo Indians of the Southwest. Pit houses or kivas were the name of primitive dwellings, which were dug into the ground and roofed over, by the people of the American Southwest (Figure 5). Besides providing shelter from the extremes of weather, these structures may also be used to store food and for cultural activities like the telling of stories, dancing, singing and celebrations (Sabjan, 2002).

Another type of earthen architecture from the Far West is the sod house, which was primarily built in the Great Plains, a region covering parts of Colorado, Kansas, Montana, Nebraska, New Mexico, North Dakota, South Dakota, Oklahoma, Texas and Wyoming, in addition to the Canadian provinces of Alberta, Manitoba and Saskatchewan (Figure 6). There is a distinct difference between this type and other forms of earthen architecture. Other techniques involved mixing the earth with another material, whether it is water, other earthen soils such as clay, or binding agents such as straw, in order to promote durability. However, sod required no material processing or mixing. The difference lies in the idea of cutting uniform blocks directly from the soil and using them to build a permanent shelter (Kampinen, 2008).

Some of the above-mentioned basic methods of buildings with earth are:

- Adobe bricks: usually made of dirt, straw and a stabilizer, then set with mortar.
- Rammed earth: moist soil tamped into forms to make a finished wall.
- Pressed earth blocks: moistened earth compacted into a hardened

Figure 5. *Pit house in Anasazi Indian State Park, Boulder, UT.*

mass with a device such as *Cinva-Ram* (Figure 7).

- Wattle and daub: mud, straw and cow shit mixture plastered on a woven branch framework (Figure 8).
- Cob: stiff mud molded into balls a little larger than a person's head, then piled up to make wall (Wolfskill et al, n.d.).

2. Traditional mud-roof construction and landscaping as a critical element

Traditional mud roofs are still used in various parts of the World, especially in areas of low to medium rainfall. They are popular because of their low cost, ease of construction, and high resistance to heat penetration. Construction materials required to build such roofs are also readily available. Traditional mud roofs consist of logs or timber joists which supported wooden poles, and which in turn supported wooden lathing or layers of twigs covered with earth. The wood type is whatever is available.

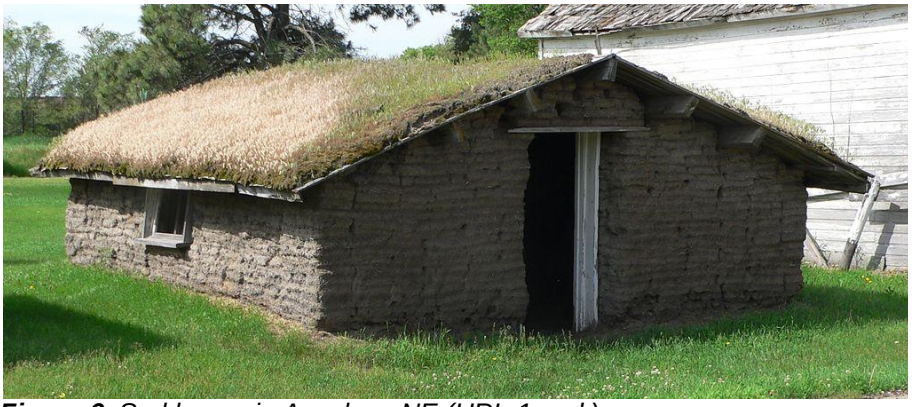

Figure 6. *Sod house in Anselmo, NE (URL-1, n.d.).*

Figure 7. *Device for Cinva-Ram (URL-2, n.d.).*

A *hezen*, about 18-20 cm in diameter, is laid across the center of the space to support the whole roof structure, either on the horizontal wooden members, which topped the wall, or on decorated cantilevered blocks, which were set into the wall. Traditionally, wooden rafters about 10 cm in diameter or rectangular timber rafters (5x10) are then laid across the top of the *hezen*. They are laid at a slight incline to facilitate water runoff. Next, twigs, plant fibers, reeds, fabric or lightweight stones (*kevek*s) are placed on top of the rafters and fixed firmly with thatch rope. In some regions, dry thatch or hay is laid over this layer to give more insulation. The dry thatch or hay also provides protection against earth penetration inside the roof. A mixture of earth and straw is applied overall the roof surface to an average thickness of 10 cm or more. Then it is stabilized with *loğ taşı*. *Çörtens* are embedded in the stabilized earth cover and the roofs were sloped somewhat toward drains of *çörtens*, which could be made from a hollowed log, a stone, a tile, or a piece of sheet metal. After the earth layer is completely dry, the surface is plastered with a mixture of earth, straw, animal dung and water, cured for about 3 - 4 days. This plaster, which is called *çorak,* serves as a good sealant against water penetration. *Çorak* can last for about two rainy seasons without a need for maintenance (Adam & Agib, 2002).

In mud-roof construction, landscaping can also be a critical element of the overall design, which must be coordinated with all of the other layers of the roof, particularly the structural and waterproofing system as well as soil and drainage system. Landscaping surely enhances the attractiveness of mud-roofed houses, but it should not be thought of as a separate decorative feature or supplementary element to be added after the house is built. It has a very important role in the success of waterproofing and insulation systems of the house. Not only do landscaping techniques complete the architectural design; they can also assist in the success of waterproofing and insulation

Figure 8. *How assorted branches, wicker and mud become a house in Wattle and Daub Technic (Sunshine, 2006).*

systems of the home. It is desirable to have plant growth on the roof not only for aesthetic and ecological reasons but energy savings as well. The important factors in the design of a mud roof are the depth of soil, type of soil and the method required for proper drainage (Flanegin, 1985).

It is clear that a plant constrained by a minimum amount of soil will not mature as fully as the same plant given a more generous amount of soil. In other words, the more soil the better. However, from a practical point of view in a rooftop situation, one is usually dealing with minimums, and rarely has an opportunity to design with ample depth (Table 1).

The thickness of the roof cover will affect the weight of the overburden. A physical characteristic of soils, having direct bearing on mud-roof design is its unit weight and water holding capacity (McConkey, 2011). Both of these measurements contribute information required for the sizing of structural members of the dwelling.

Table 1. *Minimum soil depth criteria for planting (Wade, 1983).*

Plant Type	**Grasses & ground covers**	**Small shrubs**	**Medium shrubs**	**Large shrubs / small trees**
Soil Depth	15 – 30 cm	45 – 60 cm	60 – 75 cm	75 – 90 cm
Diameter	-	45 – 60 cm	75 – 120 cm	120 – 180 cm

The majority of soil types found on a site can be used for rooftop and landscaping. This is advantageous, because it is expensive to haul material away from the site and to bring in new fill material (Sarı, 2013).

It is also essential to provide proper drainage for soil in a rooftop-planting situation. Plants will not survive if the soil is completely saturated. It is helpful to provide some slope to the earth on the surface to divert excessive moisture of the roof. It is also important to provide a drainage layer beneath the soil so that the water, which filters through the soil, is carried away (Seçkin & Seçkin, 2012).

The first method to create positive drainage is the form of the roof surface. The basic decision of whether to slope the roof surface in a constant slope from the front to the back of the structure or to leave the roof flat may affect the shape of the living space below it. The minimum slope required is 1/2 to 1 percent. In some cases, this minimum slope may not be sufficient; in fact, a slope of 1 to 2 percent is actually more practical (Roy, 2006).

A second method to promote drainage is the addition of a drainage or isolation layer beneath the soil layer. This layer is generally recommended for all soil types.

As an additional concern, it is recommended that rooftop planting have provisions for irrigation. Soils dry out quickly because of the limited capillary reservoir of the soil. A drip irrigation system could be supplied for irrigation.

3. A study on typical Anatolian mud-roof detail

In the rural areas of most Anatolian cities, the roof finds identity with mud-roof. Especially in adobe buildings, top cover generally is a mud-roof. Within the scope of this study, a typical roof section of Anatolian mud-roof houses were studied in terms of the factors mentioned above.

In Anatolian mud-roof houses, roof load bearing is solved with wood framing. Selected roof section is isolated with two different layers of dirt plaster, which are applied over *kevek*s placed on wooden rafters (Figure 9). Through moisture, originated from salt in the plaster, potential cracks occur in summer could be prevented. However salt dissolves in water, and it is necessary to consolidate the plaster in early summer. Except plaster consolidation, compressing soil with the help of a loğ taşı will complete the maintenance.

As mentioned above, accumulated water on roof is sent away by *çörten*s. The *çörten* in the selected section was shaped by cutting one piece of tuff, and was built as notched for preventing the flow of roof material and keeping it on the roof. *Çörten*, as a functional and aesthetic element, is located into parapet and extended outward to the street, as cantilever.

In fact this is existing practice of the most builders, even so, some roof attempts could be made to improve the structural, thermal and water resistance properties of the traditional earth roof. These proposed improvements are described below:

As described above, the main roof structure is constructed of local round wooden rafters with a diameter of approximately 10 cm, laid at 50 cm centers. These are supported on a *hezen* of 18-20 cm diameter. At this point, *hezen* could be laid to a fall a little steeper than the fall of the traditional earth roof, to facilitate water runoff.

Then, *kevek*s approximately 2-3 cm thick are laid adjacent to each other, covering the whole of the roof area in a solid mat, and reed (*hasır*) mat are laid over the *kevek*s (Figure 10). The reed matting, like the dry thatch or hay layer, provides protection against mud penetration through the roof. The soil mixed with straw is applied over the *hasır* in a layer approximately 10 cm thick and left to dry completely. At this stage, any cracks appearing in the surface of the soil coat could be filled with very fine sand, instead of *çorak*. Then the surface could be sprayed with water until slightly wet and plastered with a mix of lime, cement and soil in a smooth finish right up to the parapet up-stand and under and around the *çörten*. Lime-cement-soil mixing is a well-known and highly effective treatment system in which lime or cement powder is added to soil particles to increase its shear strength and reduce its compressibility. The improved earth roof will have a higher resistance to rain water penetration due to the steeper slope of the roof and the lime cement soil plaster. In addition heat insulation properties will be slightly better than the traditional earth roof. For more effective and durable protection against rainwater penetration the surface may be further sealed by the application of

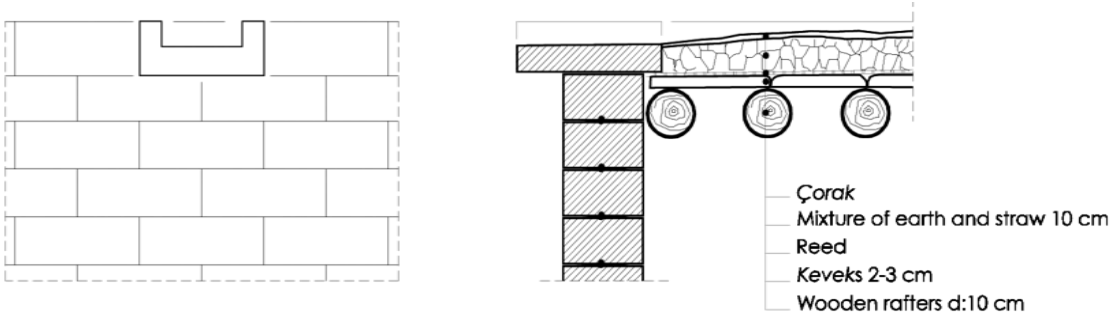

Figure 9. *Traditional mud-roof section (Çorapçıoğlu et al, 2008).*

a bitumen emulsion or covered by a durable roofing membrane such as EPDM, Hypalon, neoprene, PVC, or modified bitumen. Due to these additional materials, the cost of the roof construction would be some percent more than the cost of the traditional mud roof, but this increase can be well justified by the relative improvement in performance.

After improving the sub-structure of the mud-roof, it is time to discuss the "green" part of the roof. According to Table 1, the improved roof section will need minimum 15 cm soil depth for planting. This is twice as much weight as is supported by the corresponding beams and rafters under an ordinary traditional mud-roof. In such a case, either the number of rafters should be increased, or the weight of soil must be decreased. Second solution, using a much lighter growing medium than soil, with enough volume for plant roots to stay healthy, seems more practical and economical. For example, earth, the original base material for mud-roofs, is ten times heavier per volume than baled straw. Moisture impregnated composted straw was tested to weigh approximately 480 kilograms per cubic meter, while moist earth ranges in the vicinity of 1600 kilograms per cubic meter (Lacinski & Bergeron, 2000). With the addition of compost or manure on top, the straw roof will weigh a little less than the 15 cm of mud-roof. It also seems to give more protection to roots in the winter because of its greater volume. Actually, this interesting alternative developed in the mid 1980s. At that time, François Tanguay and Michel Bergeron were doing further work with straw bale structures in Quebec. Together with a woman partner named Clode Deguise, François and Michel formed a non-profit group in Quebec named ArchiBio, which is dedicated to researching materials and techniques appropriate to ecological housing (Steen et al, 1994). A significant part of their work has focused on straw bale building, to which they have made unique contributions such as living roofs made from bales and Michel's straw bale slabs. According to Archibio, a basic substrate made of second-quality straw bales, laid side by side with the twines cut to loosen the straw, is placed on top of the waterproof layer. Then a thin coat of manure, compost, leaves, or any other organic material is spread over the surface and left to grow on its own, or planted with grasses, sedums and flowers. The only maintenance required, besides the usual gardening work, is to add more straw periodically as the original layer decomposes and becomes thinner.

4. Conclusion

The roof is the most essential part of a building. It encloses the space within

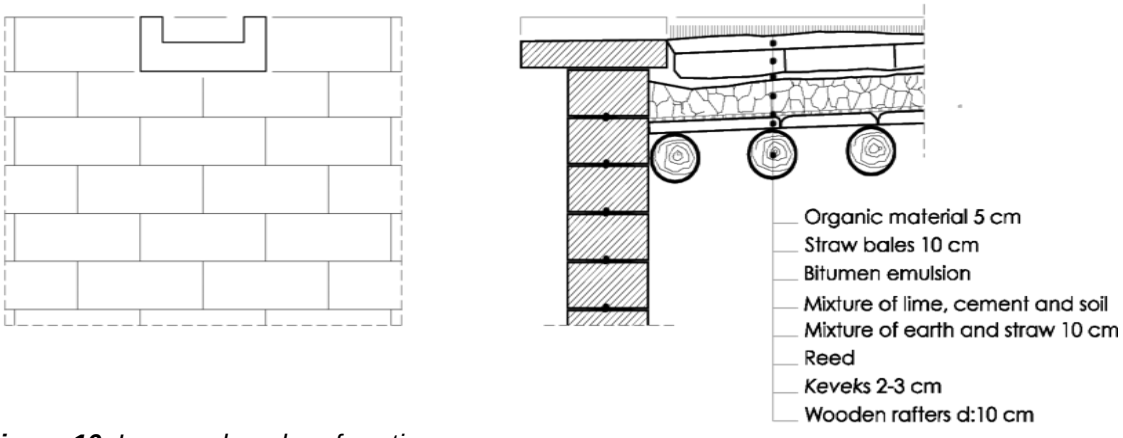

Figure 10. *Improved mud-roof section.*

the building providing vital protection from the elements. It is very important to carefully design and construct it, not necessarily always choosing the cheapest option available but one that takes into account the prevailing local climatic conditions as well as the availability of local materials and technical know-how.

Green mud-roofs and other living roofs don't differ much in the way they are built up. They are quite simple to construct. After building a low-pitched roof frame, it is covered with suitable roofing materials. Then, a waterproof layer is coated or sticked on it. And finally, the organic material comes on top of the membrane or emulsion. Green mud-roofs will last almost indefinitely if laid over good-quality waterproofing membranes; in turn, they will prolong the life of the membrane by protecting it from sunlight and weather. After all, just little maintenance will be needed over the years to turn it into a rooftop garden.

As conclusion, it has to be beared in mind that the suggestions in this paper and also other developable alternative roofing materials and methods for mud-roof houses should be tested through research projects sponsored by profit or non-profit organizations, for definite and reliable solutions.

References

Adam, E.A. & Agib, A.R.A, (2002), **Roofing Systems in Sudan**, Paris, France: Graphoprint for the UNESCO.

Anselm, A.J., (2007), "Passive annual heat storage principles in earth shelter housing, a supplementary energy saving system in residential housing", **Energy and Buildings**, 40 (2008), p. 1214-1219.

Boyer, L.L. & Grondzik, W.T., (2000), **Earth Shelter Technology**. College Station, TX: Texas A&M University Press.

Çorapçıoğlu,K., et al, (2008), **Kayseri Kırsalında Yöresel Mimari Özelliklerinin Belirlenmesi, Rehber Kitap**, T.C. Bayındırlık ve İskan Bakanlığı Teknik Araştırma ve Uygulama Genel Müdürlüğü, İstanbul: MSGSÜ.

Flanegin, M., (1985), **A Guide to Site Planning for Earth Sheltered Housing**. Master Thesis. Baton Rouge, LA: LSU.

Kampinen, A., (2008), **The Sod Houses of Custer County, Nebraska**, Master Thesis, Athens, GA: University of Georgia.

Kemal, Y., (2005), **Memed, My Hawk**, translated by E. Roditi, New York, NY: NYRB Classics.

Lacinski, P. & Bergeron, M., (2000), **Serious Straw Bale: A Home Construction Guide for All Climates**. White River Junction, VT: Chelsea Green Publishing.

McConkey, R., (2011), **The Complete Guide to Building Affordable Earth-Sheltered Homes**. Ocala, FL: Atlantic Publishing Group.

Roy, R.. (2006), **Earth-Sheltered Houses – How to Build an Affordable Underground Home**. Gabriola Island, Canada: New Society Publishers.

Sabjan, T., (2002), "Reconstructions of medieval pit houses", **The Rural House, from the Migration Period to the Oldest Still Standing Buildings (RURALIA),** Book 4, edited by J. Klapste, Turnhout, Belgium: Brepols Publishers, p.320-332.

Sarı Ozturk, S., (2013), **Enerji Etkin Tasarımda Bir Arakesit: Toprak Örtülü Yapılar**, Y.Lisans Tezi, İstanbul: İTÜ Fen Bilimleri Enstitüsü.

Seçkin, Y.Ç. & Seçkin, N.P., (2012), "Major Landscape Concerns for Earth Sheltered Housing" **International BENA 2012 Conference**, 21-24

June 2012, İstanbul, 217-221.
Steen, A.S., Steen, B. & Bainbridge, D., (1994), **The straw bale house**. White River Junction, VT: Chelsea Green Publishing.
Sunshine, P., (2006), **Wattle and Daub**, Essex, UK: Shire Publications.
The Qur'an, Kindle Edition, (2004), translated by M. A. S. Abdel Haleem, New York, NY: Oxford University Press.
URL-1 (n.d.). Retrieved April 17, 2013, http://commons.wikimedia.org/wiki/File:Anselmo,_Nebraska_sod_house.JPG
URL-2 (n.d.). Retrieved April 17, 2013, http://mha-net.org/docs/v8n2/wildac06e.htm
Wade, H. (1983), **Building Underground: Design and Construction Handbook for Earth-Sheltered Houses**. Ennaus, PA: Rodale Press.
Wolfskill, L.A., Dunlap, W.A. & Gallaway, B.M.,(n.d.) **Handbok for Building Homes of Earth**, Texas Transportation Institute Bulletin No.21, College Station, TX: Texas A&M University Press.

Toprak örtülü evlerde peyzaj: Anadolu'daki toprak damlı evler üzerine bir çalışma

Geleneksel toprak damlar, dünyanın birçok kesiminde, özellikle az ve orta düzeyde yağış alan bölgelerde, yüzyıllardan beri kullanılmaktadır. Düşük maliyetleri, kolay inşa edilebilmeleri ve ısı transferi konusundaki yüksek dirençleri gibi nedenlerle popülerliklerini yitirmemişlerdir. Bunların dışında, bu tip damların inşasında kullanılacak malzemenin temini de oldukça kolaydır.

Toprak dam inşasında, tüm yapısal detay arayışları içerisinde, peyzaj tasarımı ile ilgili çözümler de kritik bir öneme sahiptir. Peyzaj tasarımı denildiğinde, çoğu kişinin aklına toprak damlı evlerin çekiciliğini artırmaktaki katkısı geliyor olsa da, asıl katkı, dekoratif bir unsur ya da tamamlayıcı bir öğe olmasından çok daha fazlasını içermektedir. Peyzaj tasarımının, çatının su geçirimsizliği ve izolasyon sistemi üzerindeki etkisi yadsınamayacak boyutlardadır.

Anadolu'nun heybetli sıradağları Torosların Değirmenoluk Köyü'nde yaşayan yoksul ve yetim bir köylü çocuğu İnce Memed'in unutulmaz hikayesinin daha ilk satırlarında kendine yer bulmuştur toprak dam…Yaşar Kemal, köyün adaletsiz ve zorba ağası Abdi'nin baskısına dayanamayan Memed'in köyden ilk kaçışını anlatırken toprak dama yüklediği anlam, Anadolu insanı için sahip olduğu önemi çok net ifade eder. İnce Memed'in sevinçten yüreğini ağzına getiren toprak damlı evin sahibi Kesmeköy'lü Süleyman kim bilir ne zorluklarla yapmıştı o damı. Dam için kavak kestirmiş, damın ortasına koyacağı hezenibulmak için kim bilir kaç gün uğraşmıştı. Çünkü hezendi evin büyüklüğünü belirleyen. Belki de günlerce bekledikten sonra hezeni başka bir köyde bulmuştu. Hezen, evin temel kirişiydi. birde onu tutan çatal direk, daha sonrada yan yana diğer kirişler… Elbette, dost, ahbap, hısım, akraba, kendisine yardıma gelenler, eli boş gelmiyordu. Kimi saman getiriyor, kimi dama sermek için dal, kimi tahta parçası… Belki de sıcaklığını bu imeceden alıyordu toprak dam. Sırasıyla bütün direkler dama yatırılmış, üzerine tahta ve dallar serilmiş, üzerlerine samanla karıştırılıp yapılan çorak toprak (geren toprak) dökülmüştü. Loğ taşı ile pekiştirme işlemi yapıldıktan sonra geriye bir tek çörteni koymak kalmıştı. Eline bir satıl su alıp dama dökmüş, döktüğü su tamda kendisinin hesapladığı gibi meyil verdiği yerden akınca çörteni de oraya yapmıştı herhalde. Biten toprak damın sebep olduğu tatlı tebessüm, kim bilir, belki de Memed'inkinin aynısıydı. Anadolu'da Kesmeköy veya Değirmenoluk'daki evlere benzer binlerce toprak damlı ev var. Memed'in ya da Süleyman'ın yaşadığına benzer sevinçleri yaşatan, ayrı hikayelere sahip nice toprak damlı ev...

Anadolu kültüründe toprak, beşikten mezara kadar, temel ihtiyaçların birçoğunu karşılayan bir malzemedir. Toprağı ekip biçerek elde edilen yiyecekler haricinde toprak, yüzyıllardır pişirme ve saklama amaçlı mutfak eşyası yapımında, temizlik amacıyla, tedavi amacıyla ve barınma ihtiyacını karşılamak için kullanılagelmiştir. Bölgenin doğal koşullarına ve güncel politikalara bağlı olarak toprağın kullanımı

azalıp çoğalsa da, hiçbir şekilde yok olmamaktadır. Örneğin, 1940'lı yıllardan başlayarak, neredeyse hiçbir iktidar, toprak damlı evleri, korunması gereken mimari ve kültürel bir obje olarak görmemiş; hepsi "toprak dam altında medeniyet olmaz, şarka medeniyeti tuğla ve kiremit götürecektir" düşüncesinin takipçisi olmuştur. Yine de, yetmiş yıldır süregelen bu yaklaşıma rağmen, Anadolu insanı, gerek ekonomik, gerek kültürel, gerek iklimsel nedenlerle, özellikle barınma yapılarının yapımında toprağı alternatif bir yapı malzemesi olarak kullanmayı sürdürmüştür. Halen, özellikle üst örtü olarak kullanımının en yoğun görüldüğü bölgeler ise, Orta ve Doğu Anadolu bölgeleridir.

Bu çalışma kapsamında, Anadolu'daki toprak damlı evlerde kullanılan tipik bir çatı kesiti ele alınmış ve gerek strüktürel gerek malzeme açısından iyileştirilmeye çalışılmıştır. Seçilen çatı kesiti, ahşap kirişler üzerine sırasıyla yerleştirilmiş kevek taşları, kamış demetleri, toprak ve saman karışımı ile çorak adı verilen son toprak tabakasından oluşmaktadır.

Geliştirilen çatı kesitinde öncelikle, su izolasyonu sorunu üzerinde durulmuştur. Hezen adı verilen ana kirişin normalden daha eğimli bir şekilde yerleştirilmesi düşünülmüştür. Bu şekilde, çatı üzerindeki yüzeysel akış kolaylaştırılmış ve suyun yüzeyden çörtenlere doğru akış hızı artırılmıştır.

Çatı kesitindeki diğer katmanlarda herhangi bir değişikliğe gidilmezken, toprak ve saman karışımından oluşan katman üzerinde yeni bir katman tesis edilmiştir. Bu aşamada, çorak yerine ince kum ile yüzey üzerindeki boşluklar doldurulmuştur. Ardından yüzey hafifçe ıslatılmış ve kireç, çimento ve toprak karışımı ile sıvanmıştır. Bu yaratılan yeni katman sayesinde, geleneksel toprak çatının yağmur suyu geçirimsizliği konusunda daha yüksek bir dayanıma kavuşmuştur. Toprağın içine katılan kireç ve çimento, toprağın kesme mukavemetini artırmış ve topaklaşma ihtimalini azaltmıştır.

Bu oldukça basit müdahalenin dışında, daha etkin ve uzun ömürlü bir koruma söz konusu olduğunda, bitüm emülsiyonlardan ya da EPDM, Hypalon, Neoprene, PVC ya da takviyeli bitüm gibi çatı membranlarından yararlanmakta mümkündür. Elbette, bu tip müdahaleler, çatı performansı açısından önemli iyileştirmeler sağlasa da, geleneksel toprak çatının başlıca avantajlarından biri olan, düşük maliyet kalemine zarar vermekte ve belki de bazı durumlarda, bu avantajı tamamı ile ortadan kaldırmaktadır.

Altyapıda önerilen bu değişikliklerin ardından, çatının yeşil kısmı üzerinde çalışılmıştır. Çatı kesiti üzerinde yeşil bir tabaka yaratabilmek için gerekli olan minimum toprak kalınlığı 15 cm'dir. Bu da, geleneksel toprak damlı bir çatının maruz kaldığı yükün iki katına çıkması anlamına gelmektedir. Böyle bir durumda, taşıyıcı sistemin takviyesi ya da toprak ağırlığının düşürülmesi akla gelen çözüm yöntemleridir. Doğal olarak ikincisi, yani topraktan daha hafif bir malzeme arayışı, ekonomik olması halinde daha pratik ve sağlıklı çözüm olarak görünmektedir. Bu noktada gerçekleştirilen araştırmalar sonucu, ArchiBio isimli Kanadalı bir grubun geliştirdiği detay tercih edilmiştir. Bu detaya göre, toprak çatıdaki izolasyon katmanı üzerine, 10 cm kalınlığındaki ikinci kalite saman balyaları yan yana dizilmiş ve bitkisel katmanın altlığı oluşturulmuştur. Bu altlığın üstüne ise 5 cm kalınlığında organik bir örtü serilmiştir. Organik örtü, çeşitli gübreler, yapraklar ve başka birçok organik malzemenin karışımında oluşmakta ve herhangi bir çim, sedum ya da çiçek türünün yetişmesi için gerekli yaşam ortamını sağlamaktadır. Topraktan çok daha hafif olan bu katman, aynı zamanda az bir bakımla varlığını sürdürebilmektedir. Alışılmış peyzaj bakımının yanı sıra yapılması gereken tek işlem, saman balyası tabakası ayrıştıkça ve inceldikçe takviye etmekten ibarettir.

Elbette, tüm bu öneri ve geliştirmeler, salt teorik araştırmalarla, kağıt üzerinde ya da tek bir örnek üzerinde deneme ile kesinleşecek çalışmalar değildir. Güvenilir sonuçlar için, kar amacı güden ya da gütmeyen kuruluşların desteği de alınarak, alternatif malzeme ve yöntemler konusunda kapsamlı araştırmalar gerçekleştirilmelidir.