



Urban Planning and Architecture Design for Sustainable Development, UPADSD 14- 16 October 2015

## Learning from Vernacular Architecture: Ecological Solutions in Traditional Erzurum Houses

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### Abstract

Vernacular architecture has been an inspiration for innovations in environmental and socio-economically sustainable design and planning. Especially in traditional housing, the intended climatic and environmental solutions within sustainable design have already been achieved by local implementations. In this sense, as the important examples on vernacular architecture, traditional Erzurum houses are examined in the scope of this work. Thus, ecological design clues in local examples are explored by drawing attention to natural materials, traditional construction techniques, ingenious design and spatial organization strategies required for comfort, satisfaction, and well-being of building occupants.

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Peer-review under responsibility of IEREK, International experts for Research Enrichment and Knowledge Exchange

*Keywords:* vernacular architecture, ecological solutions, traditional Erzurum houses, local implementations

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### 1. Introduction

As the world has been threatened by the effects of global warming, the increase of the concentration of the greenhouse gases and the depletion of the natural reserves led people to consider about using resources, and to take precautions against climate changes. Thus, the concept of sustainability came into the architectural agenda in order to diminish the negative environmental impact of the buildings. Sustainable design methods raised as solutions for the current problems of the world, so several works started to emerge in various academic fields. However, the idea

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of the sustainability in architecture, and also its tactical goals are not new. Since the beginning of the architecture, based on local knowledge and experiences, vernacular architecture has already been trying to obtain the harmony between nature and buildings.

Vernacular architecture also known as local or regional architecture is defined as the unconscious “realization” and “embodiment” of the culture of the society with the requirements of the people in nature (Glassie, 1990). In the traditional housing patterns, all buildings are compatible with the climate and the geography. Besides, along with the shared culture, using similar materials and forms create a habitual harmony and integrity between buildings. In other words, vernacular architecture has already achieved the ecologic solutions required for living comfort; moreover current ecological discourses in sustainable housing have already been adopted in the typology of the traditional dwellings.

In Turkish civil architecture, ‘Turkish houses’<sup>2</sup>, traditional houses in all over the Turkey, are the significant examples of vernacular architecture. Turkish houses were formed according to the culture and traditions in Anatolia, also compatible with the regional requires. Despite common characteristics, Turkish houses in each region develop according to the local climate and geography, and differentiate among themselves by forms, scale and size of the buildings, usage of the materials, and most importantly by plan types. Cold and heavy weather conditions and alluvial filling that constitutes the ground of the city are the main factors of the differentiation of Erzurum houses from Turkish houses. Erzurum houses have unique architectural design character in all Turkish houses.

This study aims to analyse traditional Erzurum houses, and to reveal their sustainable characteristics. In the scope of the work, the traditional Erzurum houses around citadel are examined in terms of ecological design principles. In the framework of the study, archived five traditional Erzurum houses, built in different time periods, (Dursun Akal House, Semih Bey House, Hanağasgil House, Kabazagiller House, Ali Bayram House) are analyzed and presented in a table according to five criteria; types of planning, orientation, spatial layout, buildings elements, architectural elements (doors and windows). These principles are defined in relation to the works of Haşim Karpuz, Turkish and Islamic Art Historian, who has pioneer works on traditional Erzurum Houses (Karpuz, 1984a). Thus, local implementations against climatic and geographic difficulties are researched. As a result, this study points out the ecological solutions which are already existed in traditional Erzurum houses, and creates new design proposals that can be applied into the new constructions.

Before explaining more about the obtained solutions within traditional Erzurum houses, in order to present a better understanding to the work, the following part of the study continues with the explanations of the general information about Erzurum city, and main characteristics of the traditional Erzurum houses.

## 2. Erzurum City and Traditional Erzurum Houses

Erzurum, one of the cities of Turkey's Eastern Anatolia Region, is located in 39 ° - 55 north latitude and 41-16 longitude. Approximately, the city remains under snow in 113,1 days in a year The annual average temperature of the city is 11°, while 79.7 days are mostly clear, 200,8 days are cloudy, 84.7 days are closed (Url 2). The cold and heavy weather conditions affect the city in several aspects such as; architecture, technology, agriculture, commerce, tourism, and also social life and human relations.

The oldest information about the traditional houses relies on the observations of the travellers (Tozlu, Küçükuğurlu, 2002). According to the archives, in between 14<sup>th</sup> – 17<sup>th</sup> century Erzurum was a green city where everywhere full of trees, and houses had gardens (Tozlu, Küçükuğurlu, 2002). Later, in 19<sup>th</sup> century, Erzurum houses were described like “rabbit holes”, as embedded in the ground (Tozlu, Küçükuğurlu, 2002). Besides, on the top of the buildings which roofs were covered with grass and bushes animals; sheep, lambs and veal grazed (Tozlu, Küçükuğurlu, 2002). However, as a result of the alluvial filling ground and Erzurum to be in the earthquake zone changed that housing typology called as "rabbit hole" or "molehill". The earthquake in 1859 became a turning point in the architectural characteristics of Erzurum houses and Erzurum city in general. Over than %65 percent of the

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<sup>2</sup> See further information about Turkish Houses: Eldem, S., H. (1968), *Türk Evi Plan Tipleri*, İstanbul: İTÜ Faculty of Architecture Publications. Sedat Hakkı Eldem is a Turkish architect and academician who has several works on traditional houses.

7.000 houses in the town were heavily damaged (Tozlu, Küçükuşurlu, 2002). Before that earthquake, the houses were embedded in the ground, but then single and two-story houses were constructed with windows (Tozlu, Küçükuşurlu, 2002).

The following part of the study continues with the main characteristics of the traditional houses in Erzurum. This study examines the characteristics of the traditional houses which were built after the 1859 earthquake, and the information about the houses is analyzed within two main title; 'elements of planning' and 'construction materials and buildings elements'.

### 2.1. Elements of plan

In this section of the study, elements of Erzurum houses' plan will be explained briefly to declare more about the space organization of the traditional houses in relation to sustainability. Similar to Turkish houses, in traditional Erzurum Houses, part of the buildings, structural elements, specified areas and any other unique features of the buildings are defined with their local terms. So, this study uses original terms after their short descriptions.

In Turkish traditional houses hall, 'sofa' is the main space that majorly effects the plan organization. On the contrary, in traditional Erzurum houses *sofa* becomes a crossing space, in fact a corridor, and leaves its importance to the kitchen called as 'tandirevi' (Kukaracı, Aktemur, 2003). *Tandirevi* can be simply translated as kitchen, yet it is not the only place for cooking, it is the largest place in the house where the household spent their time together (Karpuz, 1984). The elements of *tandirevi* are 'tandır', 'tandırbaşı', 'kurun', 'seki', 'terek', 'niş', 'kiler'. (Fig. 01). *Tandır* represents today's ovens and heating devices, *kurun* means drinking fountain, *seki* is a mezzanine, and a space for eating and sitting, *terek* is the shelves for the plates, *niş* means niche and *kiler* means cellar.

The doors that open to the *tandirevi* belong to the women in the house, therefore on the ground floor, women's room, 'haremlık'<sup>3</sup> are placed adjacent to *tandirevi* (Karpuz, 1984a). In addition to *haremlık* and *tandirevi*, a cellar is also placed on the same floor. Cellar is surely for the accumulation of the food for the winter and in circumstances of drought.

In the upper floor, men's room in original term 'selamlık' or 'baş oda' is placed. In Erzurum houses, the height and the size of the rooms are higher (about 3 to 3.5 meters) and also bigger than the averages in Turkish houses, and this diversity provides house to clean air in order to heat the building (Karpuz, 1984a).

The other bathing cubicles in the houses are named as 'gusülhane'. Whereas bath places are hidden and covered, toilets are constructed outside of the house or in the furthest place in the courtyard because of the lack of sewage (Kayserili, Gök, 2013). Similar to today's ensuite-bathrooms, in Erzurum houses the bathrooms called as 'kerhiz' are constructed nearby the entrance of the room where its ground is hidden with a cover, and also carpet of the room.

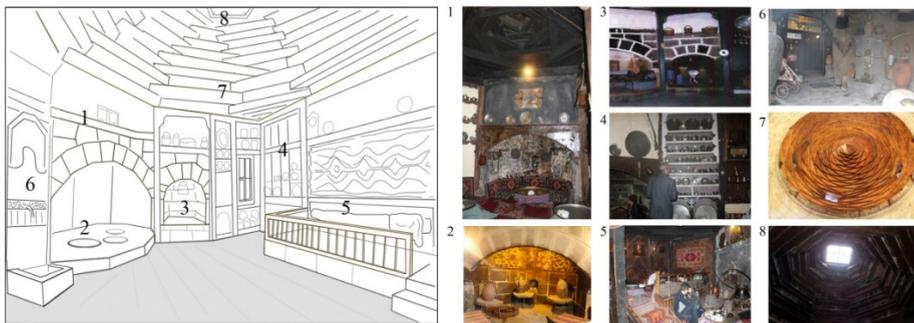


Fig. 1 Elements of *tandirevi*, (1)

1. *Tandırbaşı*, 2. *tandır*, 3. *Oven*, 4. *Terek*, 5. *Seki*, 6. *Kurun*, 7. *Kırılgaç örtü*, 8. *Skylight of the kırılgaç örtü*,  
(The drawing and the photos belong to the authors' personal archive)

<sup>3</sup>These are distinct rooms for women being separate from men. Harem (women's room) and selamlık (men's room) are common feature of Ottoman architecture. Ottoman palace traditions didn't allow the guests to access any part of private life of palace, so these way of life and terms came out in line with this purpose.

The other important spaces in the houses are barns and haylofts. As in small houses barn is located on the same level with the house; in bigger houses barns are located on ground floors in order to transfer its heat to the upper floors (Karpuz, 1984a). In addition to integration with barns and haylofts, all the houses are settled adjacently to minimize heat loss and stay resistant in the earthquakes. (Kayserili, Gök, 2013). In other words, along with their settlement and spatial organization, houses become stronger against harsh climate conditions and earthquake risk.

## 2.2. Construction Materials and Building Elements

Earthquakes have an important impact on the shaping the architecture of the city, since the city is in the first degree earthquake zone on Marmara-Kars line (Karpuz, 1984a). But still, privacy and protection from the impacts of the climate are the main factors that affect traditional houses in the city, and as clearly seen in the selection of the materials (Gündoğdu, 1997). Local materials and construction systems have been applied with local knowledge and experiences of the urbanities in relation to the function, cultural characteristics and also religious choices (Kukaracı, Aktemur, 2003).

The main materials in the traditional houses are stone, wood, earth, brick and metals (Karpuz, 1984a) (Table 1). Stones are the most utilized materials, and usually three kind of local stones are used; *karataş*, *boztaş*, *kamber* (Karpuz, 1984a). *Karataş* prevents moisture and humidity, so it is used in foundation and sub-basement (Karpuz, 1984a). *Boztaş* are used in almost every construction of the walls, while *kamber* stones may be seen in the facades of the buildings with their reddish, pink color (Karpuz, 1984b).

Wood is the most used materials after stone. Stone walls and wooden beams have been used in order to increase the flexibility of the wall against ground vibration and durability. Wood, both constructive as well as decorative elements, is utilized both in indoor and outside of the houses (Gündoğdu, 1997). The used trees in wooden constructions are, pine, poplar, willow, and also reed and cane are used for covering the roof (Karpuz, 1984b).

In the hinges of the doors and windows, and also in the knockers, sashes and locks, metal materials are used such as; iron and bronze (Kayserili, Gök, 2013). As iron mostly is used in doors and windows, bronze materials can be seen in the knockers and handles of them (Karpuz, 1984b).

Similar to construction materials, structural elements are also affected by the cold and heavy weather conditions. In order to prevent heat loss and protect from the cold weather which became -30 and -35 in the winter, walls are built 80-100 cm thickness, and are plastered with lime mortar or clay (Kayserili, Gök, 2013). Furthermore, in order to reduce the ground load, walls are built being narrowing from the below (Kukaracı, Aktemur, 2003).

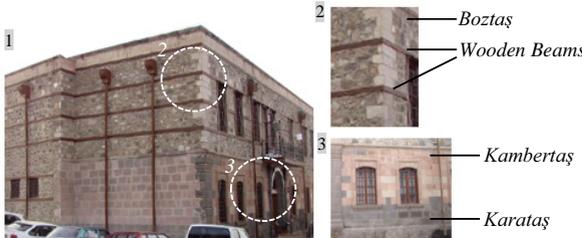
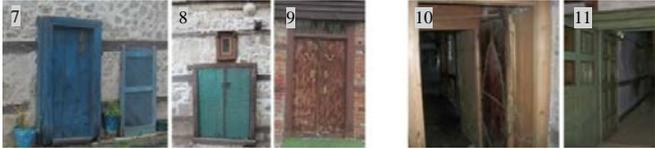
Windows are not placed close to the ground, windows in small sizes are in the upper parts of the walls and above the doors. The replacement of the windows helps to create thermal comfort in the house (Kayserili, Gök, 2013). All windows are double framed, glass and window frames are mounted close to the outer surface (Karpuz, 1984a). Moreover, windows are constructed narrowing to the outside by leading the daylight into the houses (Gündoğdu, 1997).

Three types of roofs are applied in the houses; flat, '*paşin*' ve '*kırlangıç örtü*'. The main advantage of the flat roof is to clean up the accumulated snow in the winter very easily with the help of a shovel (Karpuz, 1984a). The main function of *kırlangıç örtü* is to illuminate of the *tandirevi* where it is embedded in the ground, and no windows are on the walls (Gündoğdu, 1997). The other type of roof, *paşin* is used above the barns, and put the hood on the carrier feet from side to side (Karpuz, 1984a).

The main entrance doors in Erzurum house is mostly made of thick pines, and on its front face a wooden cage is attached called as '*tırhıç*' (Karpuz, 1984a). The reason behind those wooden cages are creating privacy and staying in touch with the street and also ventilating the house in the summer (Gündoğdu, 1997). The doors of the interior rooms are bilayer as one of the layers is taken off in the summer (Karpuz, 1984a). Briefly, as materials are chosen under the impact of the climate, cultural and habitual specialties effects the formation of Erzurum houses.

Table 1, Usage of the Materials

(Source of the photo 5: Bulut, I., Özdemir, F. (2010), Erzurum Palandöken Kayak Merkezindeki Son Kom Yerleşmesi: Beri Piri Komu, *Turkish Journal of Geography*, Vol 55, 25-33. Sources of the photos; 1,2,3, 10,11, 12, 13, 16: Çınar, S. (2012), Cephe Bezemeleri ile Öne Çıkan Bir Grup Erzurum Evi, *The Journal of International Social Research*, Vol 5, No:22, 367-390.)

Building Elements	Examples
<b>Walls</b>  -Dressed-stone, and rubble stone from local stones; <i>Karataş, Boztaş, Kambertaş</i>  -Wooden beams  -80-100 thickness  -Plastered with lime mortar or clay	
<b>Roofing</b>  -Earth, wood, stones	 <p>Flat roof      <i>Paşin</i>      <i>Kırlangıç Örtü</i></p>
Architectural Elements	Examples
<b>Doors</b>  Metals; bronze and iron, Wood; pine, poplar, willow, and also reed and cane	 <p><i>Tırhıç</i> on the left, metal exterior doors      Bilayer interior doors</p>
<b>Windows</b>  Metals; bronze and iron  Wood; pine, poplar, willow, and also reed and cane	 <p>Metal windows      Wooden windows, Wooden windows with metal cages</p>

### 3. Analysis and Evaluation of Examples of Traditional Erzurum Houses

The selected houses within the scope of this study are analyzed under five categories; type of plan, orientation, spatial layout, building elements, and architectural elements. The analyses are evaluated to specify basic practices for creating new ecological design proposals. Examples are sorted chronologically according to their construction dates (Table 2).

In the analysis, the title of the type of plan is studied within three groups (single-storey, two-storey, multi-part). These three groups were specified by the works of Haşım Karpuz. In the examination of spatial layout, it is discussed with yard and *tandirevi*, and their communicated spaces in the house. In addition, the connection between *başoda*, *sofa*, other places (barn, hayloft), wet spaces and other rooms of the building are also examined.

### 3.1.a. Dursun Akal House, 1754

**1. Type of plan:** Multi-part type

**2. Orientation:** The house is settled in the north-south direction.

**3. Spatial layout:**

**Yard:** As an organizer space, the courtyard, entered through the main door, provides access to the upstairs and the kitchen, *tandrevi*. Two separate courtyards allow the use of *haremlik* and *selamlık* separately. One courtyard goes to the *tandrevi* which is utilized as women's room; the other goes to the first floor, namely men's room. As in all Erzurum houses, courtyard of this house turns into a closed volume as a result of the climatic conditions.

**Tandrevi:** There are three separate doors of the square planned kitchen, one opens to the barn, another opens to the toilet, and the other directs to the first floor. Besides, on the right side of the entrance *kurun* is adjacent to the wall. Inside of *tandrevi*, there are *seki*, cellar, *terek* and three different sizes of *tandır* which are made of clay.

**Room / Başoda:** On the north side of the house, winter rooms are on the ground floor. The room on the east side of the house is smaller than the other rooms. There are wooden couches in front of the closet and windows in the rooms. These couches are warm sitting areas in the winter, while cool in the summer. The bathing cubicle, *gusülhane* is located in the back of the closet in the big room on the west side of the house. On the east side of the house, *başoda* is on the first floor, and has a façade facing to the street. The room is adjacent to the service room where there is a closet. A major part of the smaller room is used as a bathing cubicle.

**Sofa:** This small hall communicates with three rooms on the floor where *selamlık* is located.

**Wet spaces:** There is a toilet in the *tandrevi*. The toilet is designed close to the rooms on the northern façade. The bathing cubicles are located behind the closets both in *haremlik* and *selamlık*.

**Other spaces:** Barn and a hayloft are on the ground floor.

**4. Building Elements:**

**Walls:** The thicknesses of the exterior walls are 80-90 centimeters, whereas the inner walls' are 40 cm. While the walls on the ground floor are dressed stone, on the first floor are rubble stone.

**Roofing:** *Tandrevi* is covered with *kırlangıç örtü*. The roof above the courtyard and the other rooms are flat.

**5. Architectural Elements:**

**Windows:** They are located on the northern and southern façades. The other façades are windowless. Windows are kind of embrasures which are openings on the walls, as the openings are larger on the inside than the outside.

**Doors:** There are three doors in the house, the doors of *haremlik*, *selamlık* and barn. The door in the middle of the house is made of wood. *Tırhıç*, on the entrance door, draws the attention with its metal plated knobs, and also stone decorations; gargoyles of eaves.

### 3.1.b. Semih Bey's House, end of 18th century

**1. Type of plan:** Multi-part type

**2. Orientation:** As a result of its location in the site, the building is settled in the east-west direction.

**3. Spatial layout:**

**Yard:** The courtyard of the house consists of two rectangular volumes. The first part of the yard is the entrance, while the second part of the yard provides access to the all rooms as an organizer space. The presence of the barn helps to keep the air in the yard warm.

**Tandrevi:** It consists of *tandırbaşı* with three *tandır*, stone wardrobes, small oven and *terek*. *Seki* is located in the right of the entrance.

**Room / Başoda:** On the first floor, a small sofa gives access to *haremlik* and *selamlık*. On the ground floor, there is a winter room in front of the *tandrevi*.

**Sofa:** It is quite small in comparison with the other spaces on the first floor, and provides access to both *haremlik* and *selamlık*.

**Wet spaces:** On the east side of the first floor, there is a bathing cubicle in a room.

**Other spaces:** The cellar, which has a door to outside, is one of the most important spaces in the house, since it is utilized for keeping food fresh. It is quite larger than the similar examples. It is located on west side of the house, next to the winter room and also close to *tandrevi*.

#### 4. Building Elements:

**Walls:** Some of the façades are dressed stone; some of them are rubble stone. The partitions are lath-and-plaster and brick.

**Roofing:** Barn is covered with *paşin*. The top of *tandirevi* is covered with *kırlangıç örtü*.

#### 5. Architectural elements:

**Windows:** They are placed on the northern and western façades of the building. The courtyard and *tandirevi* are lighted by a skylight.

**Doors:** On the street façade, the house has three doors. The door on the north opens to barn, door in middle to the courtyard, and the door on the south opens to the garden.

### 3. 1. c. Hanağasıgil House, at the beginning of 19th century

**1. Type of plan:** Two-storey, square planned house.

**2. Orientation:** The house is settled in the north-west direction.

#### 3. Spatial layout:

**Yard:** The courtyard in the ground floor is divided into two separate parts. On the south, in the first part of the courtyard, there are a winter room and *haremlık*. *Selamlık* in the second part of the courtyard, is nearby the first-floor hall, and accessible by the stairs. Moreover, in the second part of the courtyard, there are a *kurun* and a toilet.

**Tandirevi:** This double-tier space is paved with flagstone. It has a skylight and *kırlangıç örtü* on its top. In the middle of the space, there is a small *tandır* on the ground. *Tandirevi* has *tandırbaşı*, *kurun*, *terek* and *seki*. There is also a flour silo next to the *seki*.

**Room/Başoda:** There are two winter rooms on the ground floor; one is on the west side, and the other is on the north side of the house. *Selamlık* is accessible by u-stairs. Central hall opens into two separate rooms; *başoda* and *haremlık*. The room on the south is *başoda*. *Haremlık* is on the east side, and has a large closet for bedding called regionally 'ceferlik'.

**Sofa:** There is a large sofa in *selamlık* that opens into two rooms. Long and narrow sofa, on the ground floor, separates *haremlık* and *selamlık* among each other.

**Wet Spaces:** A toilet is planned to be constructed at the entrance of the courtyard.

#### 4. Building Elements:

**Wall:** The corners of the house are constructed with dressed stone, while the other parts are rubble stone. On the upper parts of the façade, bricks are also used. The external façade of the house is not plastered. On the ground floor, the exterior walls are approximately 80-90 centimeter thickness, while the inners' are 30-40 cm.

**Roofing:** *Kırlangıç örtü* is on the top of *tandirevi*. The roof above the other rooms is flat.

#### 5. Architectural elements:

**Windows:** There are several windows on the northern and western façades. The double-casement windows protect the house from the heat loss in cold weather. The windows on the western façade are smaller to lessen the effect of the westerly wind.

**Doors:** The door of the main entrance on the ground floor is located in the northern corner of the western façade to lessen the harmful effect of the wind. There are three doors in the house; *haremlık*, *selamlık* and barn. The door in the center is made of wood. At the entrance, there is a *tırhıç* for ventilating the house in the summer. The entrance door draws attention with its metal plated knobs, stone decorations; gargoyle of eaves.

**Façade:** On the southern façade of the house, there are some wooden parts which are located both under and above the windows, when the walls were under construction. These wooden parts are named as 'kont', attached to the beams vertically. *Konts* are also utilized as hangers for drying food. Besides, in case of structural maintenance, these endings on the surface help to scaffold easily.

### 3. 1. d. Kobazagiller House, mid-19th century

**1. Type of Plan:** Two-storey

**2. Orientation:** The house is settled in the north-south direction

### 3. Spatial Layout:

**Yard:** There is a long and narrow courtyard on the southern part of the house. This space provides access to both *haremlık* and *selamlık*. One door opens into *tandirevi*, the other opens into the *sofa* of *selamlık*. Also, another door opens into the western winter room.

**Tandirevi:** *Tandirevi* in this house is larger than the other examples, and it is utilized as multi-purpose space in the center of the building. No windows are opened in *tandirevi*, *kırlangıç örtü* is constructed as a skylight instead. The space underneath *haremlık* was designed as a cellar which is accessible by *tandirevi*. The cellar has a *kurun* and stairs on the east side.

**Room/Başoda:** The first floor of the house is divided into two parts. The first one has a *sofa* which opens into *selamlık* and a small service space. The other one, above the *tandirevi*, is functioned as *haremlık*, and has a room linked to a *sofa*. The winter rooms of the house consist of the main room on the ground floor, the room between *sofa*, *sofa* itself, and *tandirevi*.

**Sofa:** *Sofa* on the ground floor provides access to the winter room on the west, and also *selamlık* by stairs. *Sofa* on the upstairs belongs to *haremlık*, and most its part is used as closet.

**Wet spaces:** There is a toilet under the stairs of the courtyard at the entrance.

### 4. Building Elements:

**Wall:** The walls are rubble stone. The exterior walls are approximately 80-90 cm thickness.

**Roofing:** *Kırlangıç örtü* is used (nine wooden combined).

### 5. Architectural elements:

**Windows:** The house has no windows on its northern and eastern façades. There is only one window between *sofa* and *tandirevi* on the ground floor. On the south side of the house, both on the ground floor and first floor several windows are placed in order to get benefit from sunlight.

**Doors:** As a result of its location in the site, the entrance door of the house is on the northern edge of the southern façade.

### 3. 1. e. Ali Bayram House, 1890

**1. Type of Plan:** Single-storey (built as a small family residence)

**Orientation:** The house is settled in north-south direction.

### Spatial Layout:

**Yard:** There is a two-part courtyard at the entrance. The first part of the courtyard opens into the winter room, while the second one into the *tandirevi*. The yards are long and narrow. They are divided into two parts in order to lessen the cooler effect of the wind.

**Tandirevi:** This rectangular planned space is in the center of the house. *Tandirevi* has two windows opening into the garden. There are *kurun* and *tandırbaşı* at the entrance of the *tandirevi*. *Seki* becomes an individual room, and its underneath is utilized as a cellar.

**Room/Başoda:** The room has a window looking into the street, and has couch in front of it.

**Sofa:** Without sofa

**Wet Spaces:** After passing through the courtyard, toilet, barn and garden are in the outside.

**Other spaces:** The second part of the courtyard provides access to the barn. Barn is covered with flat roof, and has a mezzanine, namely '*seki* of the barn'.

### 4. Building Elements:

**Wall:** Dressed stone is partially used on the façades. The exterior walls are nearly one meter thickness, while the inner walls are 30-40 cm.

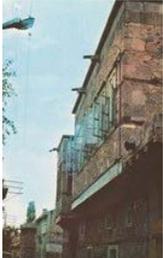
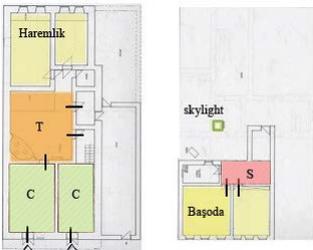
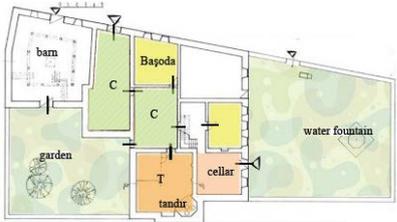
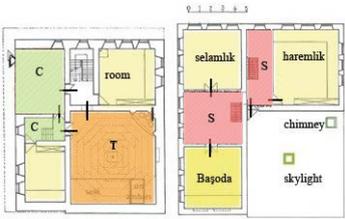
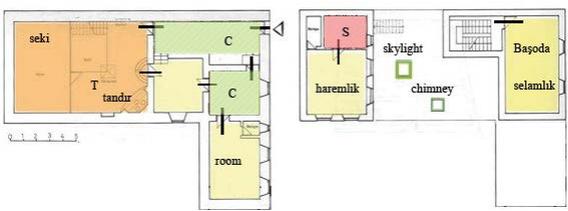
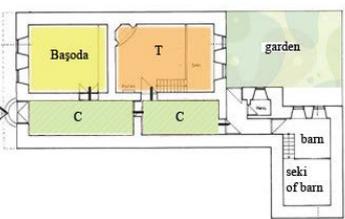
**Roofing:** Flat roof.

### Architectural Elements:

**Windows:** There are windows on the northern and southern façades of the house. The toilet and the barn get sunlight from east. On the west side of the house, there is no window.

**Doors:** The entrance door of the house is on the northern façade. Hinges and the lockers of the doors are produced with metals; iron and bronze produced by local craftsmen.

Table 2. Analysis of the Examples; 1. Type of Plan, 2. Orientation, 3. Spatial Layout (C for the courtyard, T for *tandirevi*, S for *sofa*) (Source of the photos; 1,2,3,4,5: Karpuz, H. (1984a), *Türk İslam Mesken Mimarisinde Erzurum Evleri*, Ankara: Ministry of Culture and Tourism Publications. The drawings are created by the authors)

<p><b>Dursun Akal House, 1754</b></p>	<p>1. Multi-part type 2. North-South</p>	<p>3.</p>	 
<p><b>Semih Bey's House, end of 18<sup>th</sup> century</b></p>	<p>1. Multi-part type 2. East-West</p>	<p>3.</p>	 
<p><b>Hanağasıgil House, at the beginning of 19<sup>th</sup> century</b></p>	<p>1. Two-storey 2. North-South</p>	<p>3.</p>	 
<p><b>Kobazagiller House, mid-19<sup>th</sup> century</b></p>	<p>1. Two-storey 2. North-South</p>	<p>3.</p>	 
<p><b>Ali Bayram House, 1890</b></p>	<p>1. Single-storey 2. North-South</p>	<p>3.</p>	 

## 4. Conclusion

### 4.1. Evaluation

In consideration with the results obtained from the analyses, ecological design clues for new architectural projects in Erzurum are compiled below (Table 3).

Table 3. Evaluation of the Examples

Evaluation criteria	Findings and Ecological Approaches	
<b>Orientation</b>	In Erzurum, westerly wind carries cold air. Rarely, the wind blows from the north. Therefore, the orientation of the house is the primary principle of planning to control the wind exposure. The settlements of the houses are usually north-south direction, while the eastern and western façades of the houses are windowless or with a few small windows. Due to the arrangement of the streets in parallel to north-south direction, snow and rain do not affect the dwellings in a harmful way.	
<b>Spatial layout</b>	<b>Yard</b>	Courtyards are the organizer spaces (entrance halls in today's home) which provide access to the other parts of the house. Generally in a house, there is more than one yard that divided into the parts in order to decrease the effect of the wind while preserving the privacy of the household.
	<b>Tandrevi</b>	<i>Tandrevi</i> is the most important space in the house. Since, <i>tandır</i> heats the house, the household spend their times and do daily activities such as; cooking, eating, exercising, relaxing, and working. Due to the climatic conditions, there is no window in this space, <i>kırlangıç örtü</i> is used instead.
	<b>Sofa</b>	In Erzurum houses <i>sofa</i> leaves its importance to <i>tandrevi</i> . The <i>sofa</i> concept is different from the <i>sofa</i> in Turkish houses. <i>Sofa</i> becomes a crossing space that provides communicating to the rooms.
	<b>Wet spaces</b>	Wet spaces are mostly located in the cooler parts of the house as a heat zone.
<b>Building Elements</b>	<b>Walls</b>	Dressed and rubble stone façades prevent heat loss. Wooden beams are required to make the structures to have earthquake-resistant. The thicknesses of the exterior walls are approximately one meter (in general, 80-90 cm), while the partition walls are around 50 cm.
	<b>Roofing</b>	<i>Kırlangıç örtü</i> ventilates <i>tandrevi</i> while keeping it warm, and without any window its skylight lets the sunlight inside. Flat roofs consist of wooden base and top-soil. After putting 20-25 cm in diameter pine and willow trees' branches, thatches are used. Tops of all are mud poured.
<b>Architectural Elements</b>	<b>Windows</b>	Due to their constructions, windows decrease the negative impact of the wind, and prevent heat loss by getting sunlight efficiently. As it can be seen in the plan drawings, the openings of the windows are larger on the inside than the outside, in order to get benefit from daylight more, and effect from the cold less. Besides, windows on the western façades are smaller than the other façades to lessen the effect of the westerly wind.
	<b>Doors</b>	The location of the entrance door should be on the northern or southern façade of the building to lessen the harmful effect of the wind. Especially, left or right corner of the façades are selected. Besides, in summer <i>tırhuç</i> helps to ventilate the house by protecting the privacy of the house.

### 4.3. Discussions and Current situation

Through the years, vernacular architecture has suggested effective use of natural resources, conscious choices of materials, and construction techniques in relation to the regional environment. Likewise, along with the usage of the local materials, distinct spatial organization, and ingenious construction systems, traditional Erzurum houses present

suitable ecological solutions to the geographical and climatic conditions (Table 1,2,3). On the contrary, vernacular architecture is about to be vanished in today's Erzurum city where the number of the traditional dwellings have been decreasing day by day. In the early years of Turkish Republic, in 1930s, there were almost 3.000 traditional houses in the town, whereas in 2003 only 33 houses remained (Yılmaz&Zengin&Irmak, 2003). Despite several calls by the scholars on urgent inventory work and preservation of the existing houses, nowadays most of the houses were already destructed. And just a few ones are in ruins, stuck in the middle of the new rising apartments in the unplanned urbanization.

Surely, the examples of vernacular architecture represent the time of their constructions. And so they are not suitable for the everyday life in modern world with people's changing behaviors and habits. In today's modern houses mostly one family lives in the house, unlike the old Turkish culture living all together with the grandparents and several relatives. Besides, nowadays women and men desire to spend more time together rather than separate. But still, as in the aforementioned examples, Erzurum houses preserve crucial clues for the new constructions. New dwellings can be designed in respect to the benefits of the traditional houses by obtaining their sustainable characteristics. They can be modernized according to the needs and the requirements of the time.

Concrete blocks are the products of consumerism which only serves financial benefits rather than the well-being of their residents. The new concrete blocks are against the climate and the nature of the city, and also incompatible with the culture and the social life. Therefore, the city is about to lose its identity when the new constructions do not maintain the ecological solutions that traditional buildings were already succeed. In other words, passive and economic systems left their place to the active systems, and the consumption of more and more energy for heating and cooling. This problem does not only belong to Erzurum, it is the problem of Turkey, in fact the problem of the whole world. While the cities lose their identity with similar blocks, the increasing constructions of the standard apartments prevent people to live in thermal comfort. On the other hand, vernacular architecture has several advantages. That's way; this study focuses on the examples of traditional drawings, and also creates a design proposal in order to increase the awareness of the benefits of vernacular architecture and its applicability (Fig. 2).

#### 4.2. Suggestions



Fig. 2 Proposal, (a) ground floor, (b) first floor, (c) section  
(The drawings are created by the authors)

In the several works related to Erzurum houses underline the advantages of the traditional houses and request urgent inventory works in order to preserve the existing structures. In addition, the lack of sufficient accommodation for students and travellers are determined as one of the problems of the town (Bayazit, 2007). In the work of Bayazit, whose article focuses on the problems of Erzurum in 2007, suggests that traditional houses may only survive by adaptive re-uses (Bayazit, 2007). Buildings may be restored and functioned as government buildings, hostels, dorms and any other functions decided according to requirements of the urbanities (Bayazit, 2007). In this way, the financial needs for the restoration of the buildings may be provided (Bayazit, 2007).

As a result of the growing winter tourism (The Winter Universidad in 2011 was held in Erzurum), and the increasing student capacity of Atatürk University, Erzurum has potential more people to accommodate in the town.

In that sense, this study suggests a hostel proposal which will be designed according to ecological criteria of the traditional houses. This proposal is just a suggestion to sustain and modernize vernacular architecture in the city with its advantages and cultural heritage (Fig. 2).

In the design of the proposal, a new building is designed considering with the benefits of traditional examples against the problematic conditions of climate and geography, while the functions of the spaces are altered. The hostel is located in the north-south direction. From the thickness of the walls to the materials choice, and spatial layout, it is all designed to sustain thermal comfort by reducing the heat loss. The openings of the windows are larger on the inside than the outside in order get benefit from daylight more, and effect from the cold less. Moreover, fewer windows are placed on the western façades, while they are also smaller than the windows on the other façades to lessen the effect of the westerly wind. The most use areas in the building are placed on its east side as similar to the local examples. On the ground floor, the entrance of the building has inspired from the houses with two courtyards. This partial design helps the protection from the wind. The winter rooms in the examples on the southern façade are transformed into lobby. The kitchen is designed with the requirements of *tandirevi*, and also covered with *kırlangıç örtü*. The elements of the *tandirevi* are preserved and modernized, such as *seki* is designed as a dining hall with a mezzanine. The storage spaces are placed in the north-west direction for keeping the foods cold. On the upstairs, the building core communicates with the rooms as similar to the *sofa* in traditional examples. *Selamlık* and *başoda* leave their places to the hostel rooms. All the rooms in the upstairs are covered with flat roof in order to shovel the snow in the winter. In the construction of the flat roof, regional materials are suggested. Surely, this proposal is not a certain project; it is designed in order to draw the attention to ability to adapt the design criteria in the examples of traditional dwellings.

All in all, in the case of Erzurum city, with the abandon of the natural materials, construction systems, and spatial organization, suitable life standards for the urbanities are not provided (Kukaracı, Aktemur, 2003). In that sense, for the sake of urbanities and the identity of the city, existing structures should be preserved, and become an inspiration for the construction of the new buildings. If the successful applications in the past are ignored, Erzurum loses their identity completely while the living standards decrease. In other words, vernacular architecture tells the story of the past. If we pay attention to it; architecture evolves, grows and moves forward, and people live in the buildings what they really deserve.

## Acknowledgements

This work was developed in a postgraduate course in Yıldız Technical University “Vernacular Architecture and Ecological Analysis”. We owe special thanks to the lecturer of the course Prof. Dr. Deniz ERINSEL ÖNDER for guiding this study with her profound knowledge and experience, and also her friendship and kindness.

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