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Climatic Design Approaches in Rural Settlements Located in "Çaldıran" and "Özalp" Districts of "Van" Province

Şefika ERGİN, PhD
Faculty of Architecture, Dicle University, Diyarbakır, Turkey
erginsefika@gmail.com

ABSTRACT
Rural settlements have been shaped by the experiences gained over many years. Buildings in rural architecture take shape in line with the social life, culture, natural and environmental data that vary from region to region. Climate characteristics, which is one of these variable elements, constitute a weighted factor that guides the planning process. Especially, it is possible to see that traditional residences, which are the main elements of rural settlements, were built based on plans and detailing in accordance with the local climate. Defining a climate-balanced planning of local residences, as based on mentioned experiences, is important in terms of preserving the architectural features of original buildings and ensuring the sustainability of the local texture.

In this study, it was aimed to analyze the role of climatic characteristics, which is an important factor in shaping the rural architecture of Van, and to determine the physical properties of rural houses. Defining these qualities will provide important data by expressing the settlement character caused by local differences and will contribute to guide the new settlements. In this study, rural settlements in "Çaldıran" and "Özalp" districts of Van province where cold climate prevails have been examined. Salahane village, Alikelle village and Yavuzlar village of these districts have been determined as the study areas because they reflect the local architectural character. Care has been taken to ensure that the residential buildings selected from these villages have the characteristics reflecting local data. The climatic design approaches of the houses have been evaluated with parameters such as planning features, building location, building spacing, orientation, building form, space organization and material. It has been observed that the traditional houses in the selected settlements were planned in a balanced manner with the climate and the negative effects of the cold climate have been reduced with these planning features.

Keywords: Traditional buildings, Climate-balanced architecture, Climatic design, Traditional materials, Environmental factors

1. INTRODUCTION
Rural settlements have been developed in an organic manner by integrating with the sociocultural structure of communities and the nature. The structures in these settlements have been shaped by knowledge and experiences gained over time. Factors such as climatic conditions, topography, local materials, social structure, economic livelihood and cultural conditions, which vary from region to region, play a decisive role in determining the unique character and architectural formation of each region. The environmental factors which are specific to the region where the settlements are located creates a distinguishing factor in the architecture of the settlements (Çorapçıoğlu, 2008). It is seen that each of these factors has a different degree of influence on architectural planning. As stated by Rapoport, climate and cultural factors are the most prominent elements in the formation of local housing planning. The shaping of local residential buildings depending on climate characteristics and cultural values is more evident when compared to other buildings. In addition to being an indicator of the social expression of the culture, the preferences in the planning and construction of the houses also reflect that the physical environments actually

guide the formation of these buildings (Rapoport, 1969). Local residential buildings are known to adapt well to the natural and physical conditions of the place where they are located (Nguyen, et all., 2011) (Olgyay, 1963).

It is widely accepted that the local architecture adapts well to the local climate, topographical features and available resources in terms of layout, building volume configuration, semi-open and open space arrangement, materials and construction techniques (Vellinga, 2014) (Philokyprou, et all., 2017). Local buildings have been designed with the consideration that they could show the most appropriate performance against the negative effects of the climate conditions of the region (Bodach, et all., 2014). The planning of these buildings has been performed consciously in terms of the limitations of the climate in which they are located (Coch, 1998).

In recent years, it is observed that the new houses built in rural settlements have not been planned in accordance with the climate. Therefore, the energy expenditures spent on creating the comfort conditions of the buildings have become higher. In particular, the climate-balanced design of local residences is significantly effective in providing the users' thermal comfort conditions with minimum energy consumption and in protecting from adverse climatic conditions. For this purpose, it is important to examine the planning of rural residences in regions with different climatic conditions from this point of view and to identify the practices made in terms of adaptation to climate and to include them within the literature.

In the study, the buildings located in rural settlements of Çaldıran and Özalp districts of the province of Van which bears the cold climate characteristics of Turkey have been addressed in terms of climate-balanced planning. In accordance with the purpose of the study, a preliminary research was conducted in the region and three villages were selected, namely Salahane village and Alikelle village of Çaldıran district and Yavuzlar village of Özalp district, which reflect the characteristics of the settlements and which are compatible with the climate characteristics of the region. All the buildings in these villages have been examined in terms of their architectural features, and 8 houses with different characteristics in terms of planning and detailing have been selected. These structures, which reflected the general residential properties, have been evaluated within the scope of climatic design criteria.

2. METHODOLOGY

In the study, the design approaches developed against the negative effects of the cold climate of the rural houses in the Çaldıran region of Van have been examined and evaluated. First of all, rural settlements in the region have been visited and the settlement character of the region has been observed. The criteria of the houses in these settlements that were compatible with the climate characteristics have been determined. Building examples that best reflected these criteria and also reflected different types of detailing have been determined. The projects of these residences have been drawn, photographed and their locations have been indicated on the map. The climate-based planning of these buildings have been addressed in terms of building form, location of the building, planning, building intervals, orientation, space organization and material and then have been evaluated by observational analysis.

3. PROPERTIES OF THE STUDY AREA

3.1. Geographic and Topographic Features

The Province of Van, which is located in the Eastern Anatolia region of Turkey, is between 42 ° 40 'and 44 ° 30' east longitudes and 37 ° 43 'and 39 ° 26' north latitudes. It is neighbor to the Iran in the east. The province of Van is located on a rugged geography in the Eastern Anatolia Region, where the mountain ranges come very close to each other and at the same time rise towards the east. The surrounding high mountains form the border of Van province. Van province was established on a slightly inclined land which is

5 km away from the eastern shore of Lake Van, located in the hollow part of the Eastern Anatolia Region covered with volcanic mountains. With an area of 3764 km2, Lake Van constitutes the largest closed basin in the region. The largest lake of Turkey is in the form of a graben. Altitude is about 1725 m (Karaca,et.al., 2019).

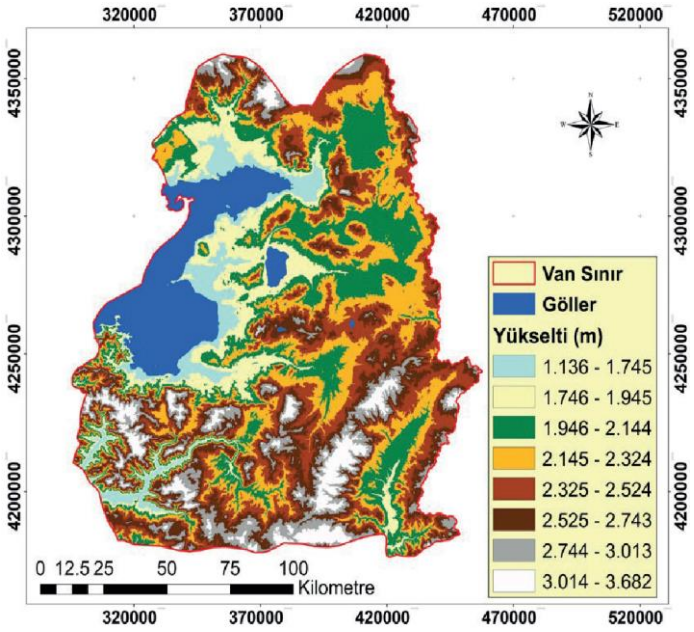


Figure.1. Elevation Map of Van (Karaca,et.al.., 2019)

Most of the mountains around the city are volcanic. There are about twenty mountains with heights ranging from 3668 m to 2560 m. Aladağ (3351 m) and Tendürek Mountain (3542 m) located in the north separate Van from province of Ağrı. Suphan Mountain (4434 m), Nemrut Mountain (3050 m), Erek Mountain (3250 m), Kuh Mountain (2850 m), Kazan Mountain (2890 m) and Irgat Mountain (2750 m) are the main high mountains (Uluçam, 2000). Erçek, Hoşap, Van, Başkale, Havasor, Erciş, Muradiye and Özalp basins which are among the plateaus opening towards the shores of Lake Van from the east are the plains suitable for settlement and agriculture. Van Plain is the largest of the coastal plains (Uluçam, 2000). These plains, which have an economically important place, are also the areas where settlement and population density are the highest.

Çaldıran district, which is addressed within the scope of the study, was established in 1987 on the plain also having the same name. Its area is 413 km² and its altitude is 2050 meters. It is 113 km away from the city center of Van. Animal breeding and trade are common activities in the district. Özalp district was established in 1948 and its area is 1558 km², its altitude is 2008 meters and its distance to the city center is 60 km (Kılıç, 2006).

3.2 Climate

Surrounded by mountains, Van is 1725 meters above the sea level. In the middle of the Van basin, Lake Van is located with an area of 3574 km². Located in the Eastern Anatolian region of Turkey, the province of Van has a continental climate which is dominant in the region. The water of Lake Van heats up later and cools down later than inland areas. While it ensures that the areas on the shores of the lake are warmer in winter compared to the surrounding regions, it also prevents the excessive rise of temperatures in summer and causes the continental climate to be lighter. Although more severe continentality is observed in other provinces of the region, Lake Van is a factor that reduces the degree of continentality in the areas around the lake. In this respect, the coastal regions within the Van Lake basin are microclimate areas where the degree of continentality is significantly reduced. The further away from the lake, towards the east of the region and especially

towards the northeast, the intensity of the continentality increases (Alaeddinoğlu F., 2006) (THEP, 2016).

Van province is located in 4th Region within the climate zone classification of Turkey. In the region, which has a cold climate, winters are especially long, severe and snowy. According to the average values observed over the years (1939-2019); in terms of monthly average temperature values, the average highest value was measured as 28.4 ◦C in August and the average lowest value was measured as -7.5 ◦C in January. Between the years 1939-2019, the maximum temperature value was measured as 37.5 ◦C on 27.07.1966 and the minimum temperature value was measured as -28.7 ◦C on 19.01.1964 (Fig.3.). The average number of rainy days in Van is observed the most in April and the least in August. Average monthly precipitation was measured as 55.6 mm maximum in April, and as 5.8 mm minimum in August (Url-1) (Fig.3.). Due to the high altitude in the north and east of Van, the amount of precipitation is higher. Snowfalls are seen between November and the end of April. Van province is among the sunniest provinces of Turkey. The name of the province is known to have been "Tuşba" during the Urartu Civilization. The word Tuşba means "the place with plenty of sun" (Karaca,et.al., 2019).

Although westerly winds are dominant in the west of the basin, in the east part of the basin westerly winds are effective in spring and summer, and easterly winds are effective in autumn and winter. Thermal contrasts between the lake and the surrounding high plateau and mountains have also influenced wind directions by causing pressure differences. Different warming conditions enabled the rise of breeze winds from the lake to the land during the day and from the land to the lake at night (THEP, 2016).

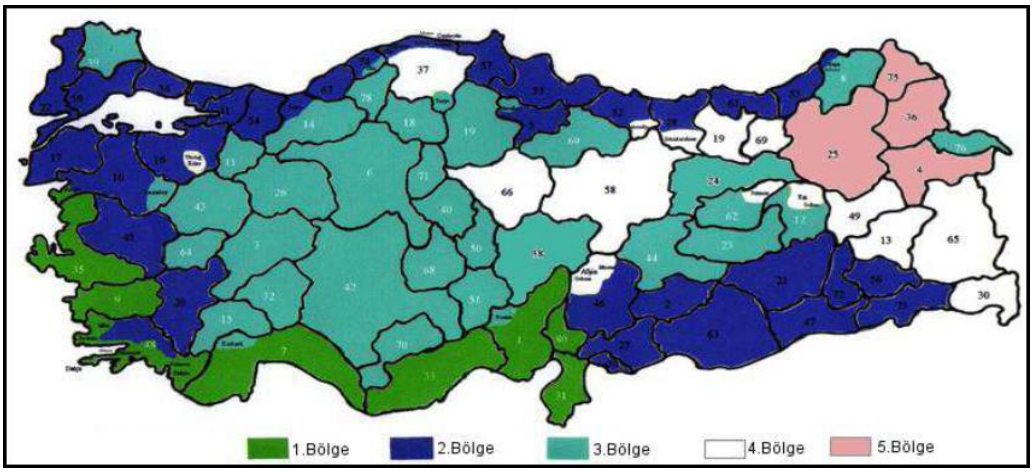


Figure.2. Turkey's climate zones according to TS825 (TS825, 2013)

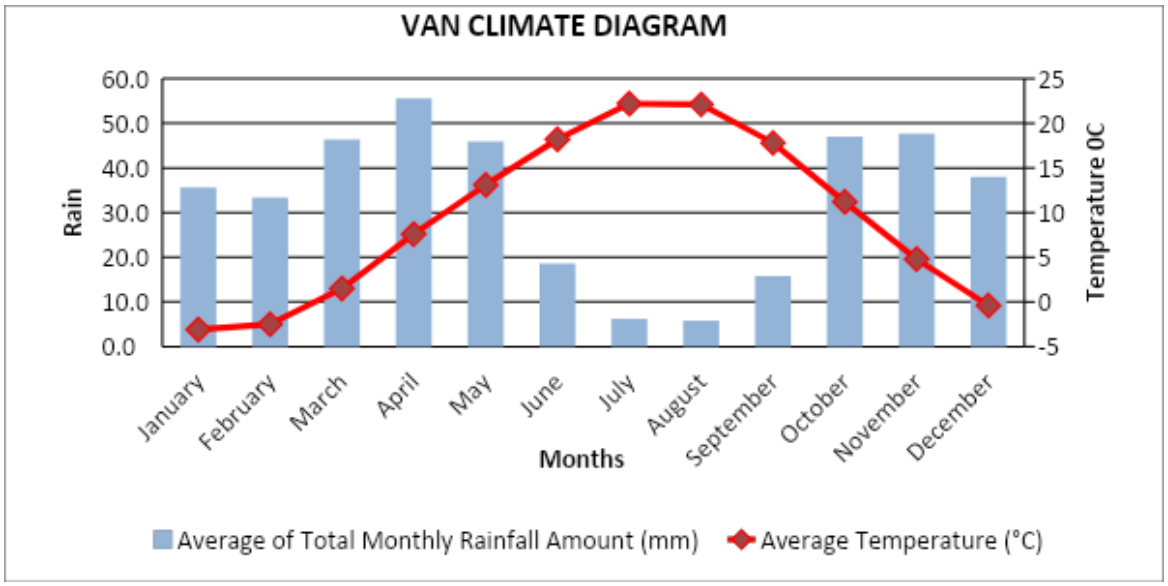


Figure.3. Average monthly temperature and precipitation values of Van province (1939-2019) (Url-1)

3.3. Settlement Characteristics

Rural settlements around Van are shaped according to the geographical and topographic characteristics of the region and the economic income sources of the local people. These settlements are located densely between 1600m and 2000 m altitude and can be seen up to 2400 m altitude. Levels higher than 2000 m are not preferred because of the decrease in the average temperature, the decrease in agricultural activities and also due to difficult negative effects of the long and harsh winter period. The settlement areas are mostly between 1700 m - 1800 m. The reason why settlement areas are densely located at these levels is that it is the most suitable level in terms of agricultural activities. Agricultural activities decrease and animal breeding increases in settlements at higher levels (Gürbüz, 1996). It can be said that the economy is an important factor in the selection of rural settlement areas.

Among the study areas, Çaldıran is 2046 m and Özalp is 2008 m high (Url-1). Since the rural settlements in Çaldıran and Özalp regions are higher than 2000 m, agricultural activities are very low in these areas. Depending on this situation, animal breeding is more common. Çaldıran is located on the transit road from Europe to Iran. There are 96 rural settlements connected to the district. Of these settlements 64 are villages, 27 are towns and 5 are quarters. Özalp district was established in 1948. It has an important place in the border trade with the Iranian state. Özalp has a total of 78 rural settlements consisting of 54 villages, 4 quarters and 20 towns (Kılıç, 2006).

Alikelle village (Çaldıran) and Yavuzlar village (Özalp) within the scope of the study are slope settlements while Salahane village (Çaldıran) is a plain settlement (Fig.4.) (Fig.5). In all of the mountain, slope and plain settlements which have been studied, the structures are located close to each other. Factors such as climate, common needs, family ties and social relations played a determining role in the distance between the buildings. The layout of these settlements was not shaped by a specific planning, but by an organic development process in line with needs. Each residence's own plot is bordered by the garden wall. Units such as barn and food store, which are used for economic activities are located in the garden area. The size of the garden area varies according to the size of the household owner's economic resources.

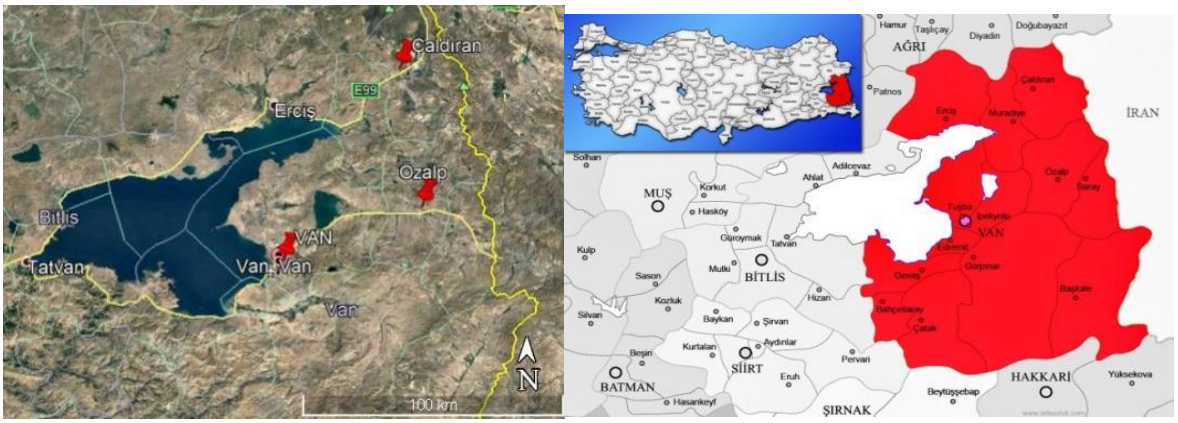


Figure.4. Van province and villages where the study was conducted (Url-2.)

There is no central common area in rural settlements of these regions. There is a central road axis passing through the settlements and also secondary roads that provide access to the houses from this main road. Usually houses have their own garden areas in front of them. Due to the presence of these garden areas, the scattered positioning of the buildings did not allow the houses to be adjacent or close enough to form a street. Garden areas have a usage pattern devoted to the income sources of the households. Openings are left between the parcels that are bordered by the garden walls.

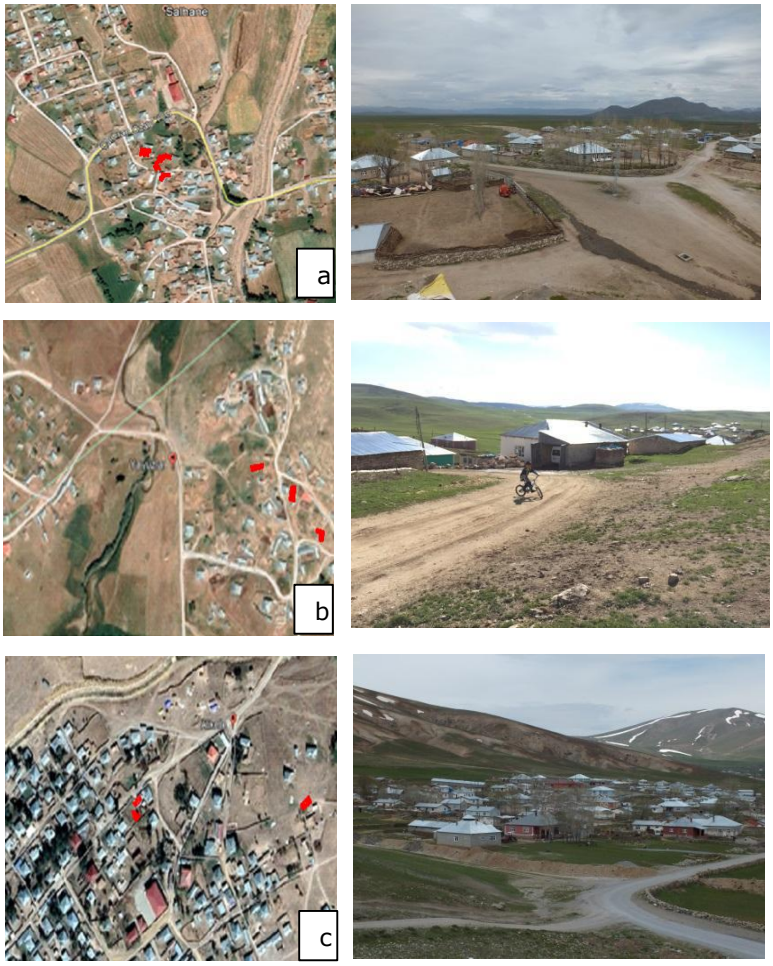


Figure.5. General view of the settlements
a) Salhane Village b) Yavuzlar Village c) Alikelle village

4. CLIMATIC DESIGN APPROACHES IN HOUSING ARCHITECTURE

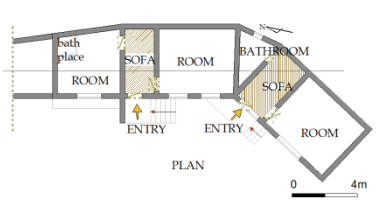
4.1. Planning Features

The houses in the region are generally single-floor and two-floor ones are less in number. Both floors of the two-floor residences consist of spaces used by households for their daily activities. The upper floor is reached by the stairs outside the house. Plan types with outer hall, inner hall, middle hall and mixed (more than one different hall type) were used in the planning. There is no plan type without a hall in the region. It is seen that the plans are shaped by developing from the hall-room layout, which is the basic plan type of the region. Some of the plans are in the order of hall-room, room-hall-room (Fig.6.a.) (Fig.6.b.). Some plans are shaped by repeating the basic type (hall-room) in one direction or two directions. The houses in which the spatial arrangement is planned in one direction tend to surround the parcel boundaries (Fig. 6.c.). Apart from the need for shelter, units such as the tandoor, barn, poultry and the garden walls complete this structure. The plans created by repeating the spatial arrangement in two directions are more compact (Fig.6.d.).

Rural residences in the region consist of rooms, halls, kitchen, toilet, bathroom, warehouse, pen, barn, manger and tandoor house units. Rooms are used for various purposes and can be more than one. Houses have a main room where households perform daily activities such as eating, resting, sitting, and sleeping. In addition, there are usually rooms where guests are accommodated and belongings are stored. There are niches of different sizes and depths planned according to the purpose of use in the rooms.

It is common to use traditional tandoor houses in the region. The tandoor house is a multi-functional space used for all activities such as cooking bread and food, heating water, heating and washing (Fig. 6.e.). This unit, which was planned as closed and used as a kitchen, was named as a "house" and defined as the tandoor house, although it consists of a single space. There are no windows in this rectangular planned space. In order to evacuate the smoke that comes out during the burning of the tandoor, a gap is left at the top of the place that acts as a chimney. This place, which is completely closed to external climatic conditions, is preferred for many functions due to its sheltered status in cold periods. The fact that this place, where most of the activities are carried out, has structural features that are quite sheltered against cold climate features, has increased its usage advantages. This space is an example of analysis developed against climatic features.

Access to the houses and other units is provided from a garden area in front of each house. The spaces do not have a separate entrance outside the garden. Residential entrances in this area, which receives heavy rainfall, are at least 60-70 cm higher than the ground level. The top of the entrance is covered with eaves. In some houses, in order to protect the entrance of the building from precipitation, the eaves of the roof are used longer on the entrance facade. In plan types with middle halls, the entrance of the houses is recessed inward and is further inside the room at the outer border of the building. In this widely used planning, the entrance to the house is protected by a roof eave without the need for a separate eave.



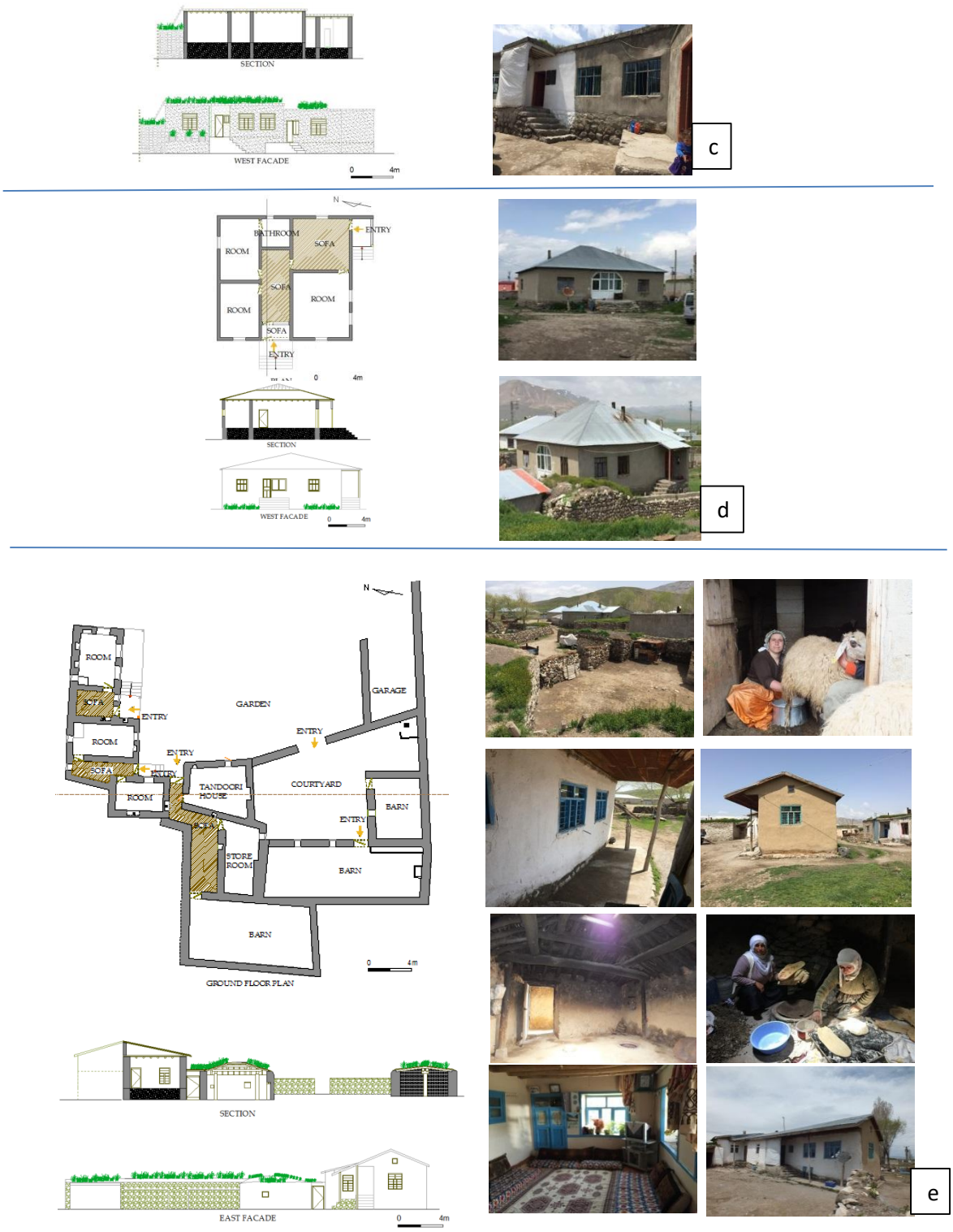


Figure 6. Layout Planning examples
a) Alikelle village b) Yavuzlar Village c), d), e) Salhane Village

In most of the houses, units such as barns, pens, and warehouses are located close to the housing mass and planned around a courtyard. This specially created courtyard area is used for milking the sheep. Surrounded by units or walls, this courtyard separates the

economic activity area from the garden area as well as creates a sheltered working area against the wind. The transition from the garden to this courtyard is provided by a gap or door. Both the garden and this courtyard wall are 2-3 m high in order to provide privacy and protect the sheep and goats from the wild animals in the region.

4.2. Location of the building

Within the scope of the study, Yavuzlar village (Özalp) is located on the slope directed to the East and West between the two mountain regions, Alikelle village (Çaldıran) on the slope facing the South and South east of the mountain, and Salahane village (Çaldıran) on a plain area. The amount of solar radiation affecting any surface varies according to the slope and direction of the land surface. Soil temperatures are also different depending on the slope and direction. It is advantageous for these settlements in mountainous regions to prefer south, east and west slopes in terms of benefiting from solar radiation. In addition, these places where the slope settlements are located protect the buildings from the cold north wind. It is seen that Yavuzlar and Alikelle villages, which are slope settlements, are located at the lower parts of the slope. In this region where the cold climate prevails, wind is a factor that requires protection. The residential areas located at the lower parts of the slope are more protected from the wind because they are exposed to less wind force than the high points.

4.3. Building Intervals

The position and height of the buildings relative to each other is important in terms of the level of solar radiation and wind effects of the buildings. In regions where the cold climate prevails, it is necessary to develop design approaches that will benefit from solar radiation at the maximum level and protect from wind.

Depending on the parcel usage of the rural houses and social life in the region, it is seen that adjacent plans have not been developed, but the houses are located close to each other (Fig.7.). Due to the close distance of the houses in the settlements and the fact that most of them are single-floor, the distance of the buildings to each other is greater than the depth of the shaded area that occurs. The spacing of the existing structures does not prevent each other from receiving solar radiation. In addition, the close spacing of the structures enables them to function as a wind barrier for each other. This creates an advantage in reducing the wind speed and effect. In addition, the formation of wind tunnels is prevented by the spacing of the structures and the wide openings created by the garden areas.

Figure.7. Building intervals in settlements

4.4. Building Orientation

The amount of solar radiation affecting the building surfaces changes depending on the geographic characteristics of the area such as latitude, slope, direction and seasons, and this affects the average radiative temperature. This situation is determinant in the change of the inner surface temperature of the building and the indoor temperature of the space. The orientation of the buildings is directly effective in making maximum use of solar radiation, and it is a parameter that should be evaluated in terms of thermal gain in spaces in cold climate regions.

The use of facade openings of rural houses in the study area was designed considering the effects of the cold climate of the region. With the aim of increasing the amount of heat gained indoors by means of solar radiation, the openings of the spaces have been generally made as facing south. The windows used on the south facades are larger than the windows on other facades.

The longer entrance facades of the houses, which are accepted as front facades, are generally facing south. Depending on the parcel status, the houses that cannot be accessed from the South facade are mostly accessed from the East and West facades. A small number of house entrances are on the North facade as required by the parcel situation. Generally, no openings were used on the northern façades of the buildings in order to avoid the negative effects of the cold and hard weather conditions. The windows are made of wood and they are flat and few in number. There are small windows next to the entrance doors of the houses to illuminate the hall.

The fact that the buildings are oriented to the south is effective in reducing the effect of the winds in the region and in preventing heat losses in the buildings. Most of the houses in the region are located in accordance with the climate, providing solar radiation gain and wind protection. In addition, it is seen that the places that households use the most during the day are planned on suitable facades for receiving sunlight, considering the climate factor.

4.5. Building Form

Building form is effective in benefiting or protecting from external environmental factors. Depending on the building form, the change in the total exterior, facade and roof surface areas and proportions creates a difference in the level of being affected by climatic conditions. Compact, square structures that minimize the outer surface are suitable for cold climates.

The determining factors in formation of the buildings in the region have been developed by the organization and plan types depending on the use of space. It is observed that most of the houses in the investigated settlements are square or close to a square plan, while a small number of houses are rectangular.

It is aimed to minimize the surfaces exposed to outdoor conditions and to reduce heat losses in the cold period by shaping the houses close to the square. Most of the buildings in the settlements are built as compact as possible in order to be protected from external weather conditions. This planning type is a more suitable form for cold climates. It is also seen that some of the buildings were built buried in the ground. This is to reduce the outer surface area of the building and to protect it from cold weathers.

4.6. Space Organization

The main spaces that make up the residences in the region are the rooms and halls at the most basic level. The organization of the space is hall-centred on the horizontal or vertical axis. Entrance to the residence and access to the rooms is provided from the hall. The layout of the spaces in the planning has been focused on benefiting from solar radiation. The most used places during the day are placed in a way that they can be fronted to the South. The spaces that cannot be faced to the south are oriented to the West and East.

In the housing planning of the region, tandoor houses are important places that can provide heat protection. There are few examples in the region where the main place of daily activities is used as a tandoor house. In majority of the houses, the tandoor house is not jointly planned with the main living space but is located as a separate space. These tandoor houses are also included in the spatial organization as a part of the building. In most houses, the tandoor house is entered without leaving the building via a connection provided from the hall. It is seen that the entrance of the tandoor house is provided from the closest distance to the entrance of the house in plans that are not connected with the hall. With this planning, access to the tandoor house is provided without much exposure to the outside environment during cold and windy periods when snowfall is intense. In the planning of the houses with these tandoors, it is seen that the common wall connection is established with the room or hall by placing it back to back. This spatial layout is aimed at providing heat gain from this space during the cold period. The tandoor houses, whose entrance is inside the building, also undertake the functions of spaces such as kitchens and bathrooms. The fact that this place is warmed on the days when the tandoor is used creates a more suitable environment for taking a bath. For this reason, an area was reserved for washing in the tandoor house (Fig. 8.a.). This area can be open and in a corner of the tandoor house, as well as being used as a closed area by creating a limiting wall. It is seen that the tandoors whose entrances are from the outside of the building, are not used as kitchens or bathrooms and planned by connecting with the hall. In some houses, it is seen that the bathroom is not included as a space, but instead a washing area is created within the room (Fig. 8.b.).

Figure.8. a) Bathroom area within the tandoor house b) Bathroom area within the room

Most of the residences in the region are single-floor and two-floor buildings are less in number. The use and organization of the ground floor of single-floor or two-floor houses are similar to each other. There is a hall, room, kitchen, bathroom, tandoor house on the ground floor, while on the upper floor there are only rooms connected to the hall. All of the places where daily needs are met are on the ground floor. The room or rooms on the upper floors of two-floor residences are for the use of guests only.

In the organization of the space, units such as toilet, warehouse, pen, barn, and manger are generally planned close to the house, but independent of the building mass. In some residences, service spaces such as warehouse and wet area are planned on the North facade and thus protect the space in front of it from outside weather conditions during cold periods.

4.7. Optical and Thermo-physical Properties of Building Envelope

The properties of the building envelope, which consists of components such as walls, windows, doors, roof and floor covering, are very important in ensuring heat preservation by preventing heat losses in interior spaces. In cold climatic regions, it is aimed to minimize the heating need by the high heat retention and storage properties of the building envelope.

Walls constitute the main bearing element of the masonry construction system applied in rural buildings. In the region, the walls, which serve as the carrier elements are made of stone and mud brick. Depending on their heat retention and heat storage properties, stone and mud brick which are used as wall materials, reduce the thermal loads of the space thanks to the time delay effect that prevents the temperature of the space from falling suddenly by discharging this heat back in the evening when the heat is needed. With this feature of the walls, the amplitude of the external air temperature effect in the cold climate region is reduced and it is ensured that it passes into the indoor environment after a long time. The thermal capacity of the materials is directly proportional to the specific heat and mass amount. For this reason, increasing the thickness of a material with high thermal capacity reinforces the effect of thermal mass in the envelope. The wall thickness of the buildings in the region is generally 50-60 cm, and this thickness was measured as 70-80 cm in some buildings. It is also observed that the northern walls of some houses are thicker than other walls. Thickness of mud brick and stone walls with high heat capacity increases the thermal mass effect and decreases the heating loads, especially for these buildings located in the cold climate zone.

The upper floor of the buildings in the region is an earth roof. In the construction of the top cover, wooden posts with an average diameter of 15-16 cm are placed and aligned on the wall in the direction of the short edge of the space. After it is covered with materials such as wood and bushes, 40-50 cm thick soil material with added salt and straw is laid and the upper floor of the house is formed (Fig. 9). The thermal conductivity of the materials used in the upper floor, which is a part of the building envelope, is low. The earth roof prevents the internal temperature of the spaces from changing in a short time thanks to its heat retention and heat storage features. The middle part of the earth cover with high thermal performance is poured higher and is made inclined towards the edges. The inclination helps the rain to drain more easily. It is seen that the new residences built from reinforced concrete and some traditional houses in the region have a wooden roof added over the upper floors. These added roofs are intended for the removal of precipitation from the building in winter season.

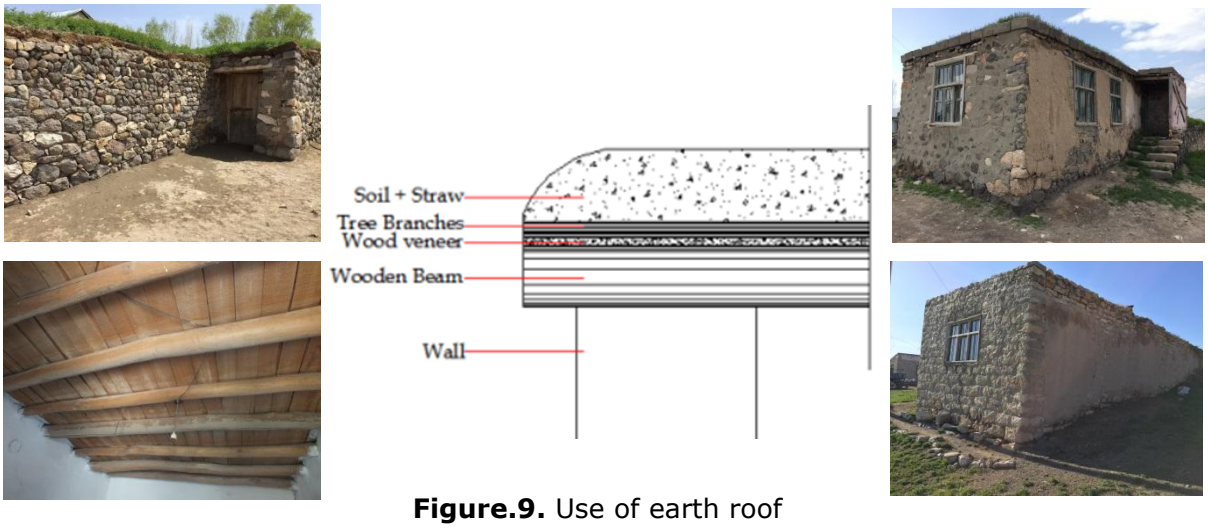


Figure.9. Use of earth roof

The load-bearing walls of the tandoor house, which is included in the house planning, are also made of stone or mud brick. The upper floor of the square-planned space, which is larger than a typical room size, is different from the other parts of the house. The rectangular or hexagonal form created by overlapping wooden beams is created by raising on a vertical axis (Fig. 10). The roof, which is elevated on the vertical axis and covered with earth, looks like a dome from the outside. Except for the opening in the middle of the roof system that functions as a chimney and provides lighting, there is no gap on the outer surface of this space. When the space is not used, this gap is covered.

The windows in the shell of the buildings are wooden frame and single glazed. The wooden frame of the window is used in the outer wall surface. The outer doors are wooden and the top and surroundings of the entrance are protected against external conditions.

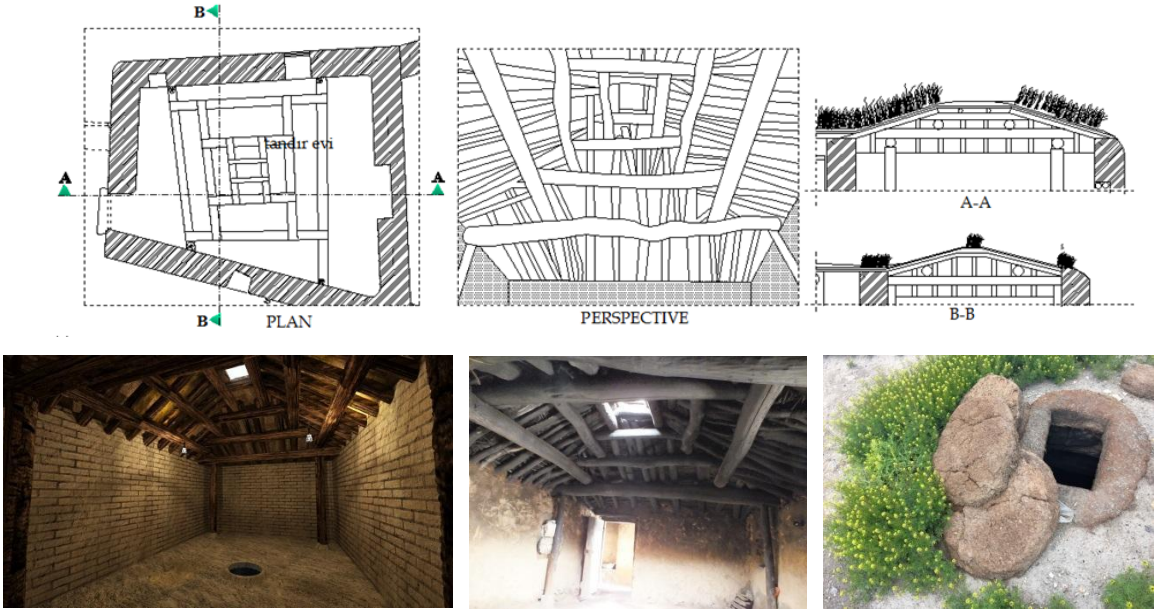


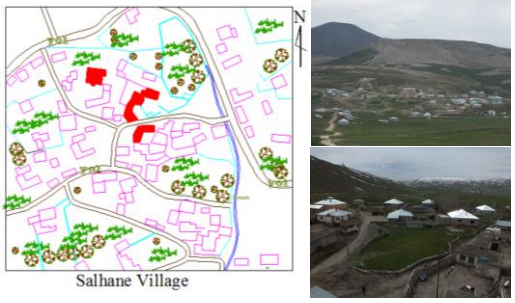
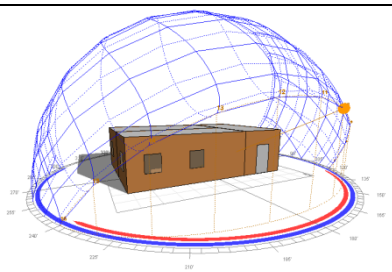
Figure.10. Upper covering of tandoor house

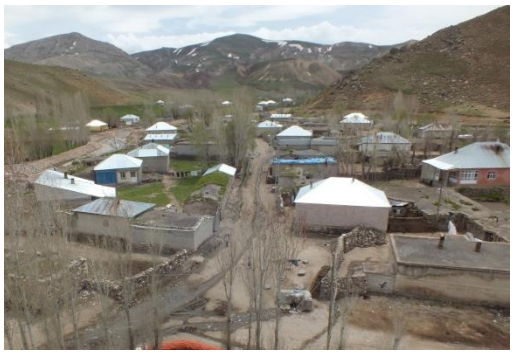
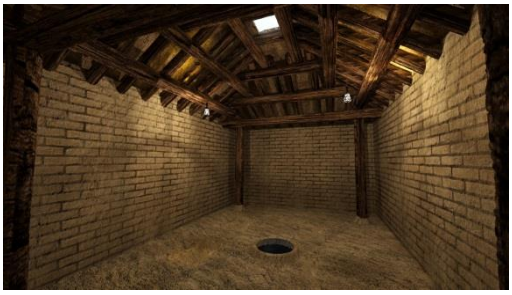
CONCLUSION

Rural settlements contain unique examples of local buildings that can adapt to the climatic characteristics of their region. In this study, climatic design approaches of residences in rural settlements in Van province have been evaluated. On-site examinations show that the buildings in the rural settlements of the province of Van have been planned in accordance with the cold climate conditions prevailing in the region. Especially the harsh and cold climate of the region has made it necessary to develop architectural solutions to reduce the adverse climatic conditions during the cold period of the year.

Climatic design approaches in residences have been discussed in terms of planning features, building location, building spacing, orientation, building form, space organization and materials, and architectural features have been examined (Table.1.). It is clearly seen that the most determining factor in shaping the buildings in the region is the climate. With the planning features developed for the negative effects of the climate, it has been possible to adapt to the harsh conditions of the cold seasons. In addition, the local architectural residences within these settlements gave the region a characteristic identity with the existing texture. The climate-balanced architecture of the residence examples in the region can be a resource for the newly designed houses in the region in terms of climatic planning principles.

Table.1. Climate design approach of houses

Parameter		Cold climate climatic design approaches of buildings
Planning Features		- A tandoor house has been planned, which has many functions and has structural features protected against external environmental conditions. - House entrances are at least 60-70 cm high to protect them from heavy snowfall. - The top of the house entrances is protected with eaves. - The roof eave of the entrance facade is longer against the effects of precipitation. - In the middle-hall plan types, the entrance of the houses is located inside the outer axis and protected by the roof eave. - Garden walls are high in order to reduce the effect of wind. - As a working area for economic activities, there is a small-sized, wind-protected courtyard in the garden.
Location Of The Building		- The fact that settlements in the mountainous regions have been located on the slopes facing the South, East and West directions provides an advantage in taking advantage of solar radiation. - With the placement of settlements on the slope, the effects of the cold north wind are reduced. - Since the slope settlements are located on the lower side of the slope, it is more protected against wind force when compared to higher points.
Building Ranges		- Although the distances of the buildings do not create a shadow effect on each other, they are close enough not to hinder the gain of solar radiation. - The close spacing of the structures enables them to act as wind barriers for each other. - Thanks to the scattered positioning of the buildings and the wide openings created by the garden areas, the formation of wind tunnels has been prevented.
Building Orientation		- The places that are used the most during the day have been planned on the facades suitable for receiving sunlight. - Most of the openings of the spaces are in the south direction to provide heat gain through solar radiation. - The windows used in the south facades are larger than other facades. - Most of the entrance facades of the houses are south-oriented.

		- Generally, no openings were used on the northern facades of the buildings to provide heat protection.
Building Form		- Most of the residences are planned as a square or close to the square in order to have a minimum external surface area. Rectangular houses are few in number. - In order to be protected from cold weather conditions, the buildings were built as compact as possible. - The longer facades of the residences in rectangular form are South-oriented. - A part of some buildings have been planned to be buried in the ground in order to reduce the outer surface area and to protect them from cold weather.
Space Organization		- The plan type with no hall, in which the spaces have direct connection with the external environment, has not been used. - The tandoor house has generally been planned side by side with the room or hall in order to provide thermal gain. - The tandoor house is located at the closest point to the hall or the house entrance, in order to provide easy access during the cold period. - It is also used as a kitchen and bathroom in order to benefit from the interior temperature of the tandoor house. - Service spaces in the houses have been planned on the northern facades, contributing to the heat preservation of other spaces.
Optical and Thermophysical Properties of Building envelope	 	- Stone and mud bricks, which have high heat retention and heat storage properties, have been used as wall materials. - Wall thickness is generally 50-60 cm, and thermal mass effect has been created with thick walls used up to 80 cm. - By using materials with low thermal conductivity in the upper floor, the internal temperature of the spaces is prevented from changing in a short time. - In order to prevent snow or rainfall from accumulating on the upper floor, the middle part of the earth cover was made higher and inclined towards the edges. - In tandoor houses, the heat capacity has been increased with a dome-shaped and elevated earth cover laid on the wooden beams which have been placed on top of each other.

REFERENCES

AL M.T., Adıgüzel C., Bayat D., (2011). Van Province 2011 Environmental Status Report. Republic of Turkey, Van Governorship Provincial Directorate of Environment and Urbanization. Van.

Alaeddinoğlu F., (2006). Determination of Tourism Potential of Van Province and Recommendations for Planning. Doctoral Thesis. Ankara University Institute of Social Sciences, Department of Geography (Regional Geography). Ankara.

Bodach S., Lang W., Hamhaberc J., (2014). Climate responsive building design strategies of vernacular architecture in Nepal, Energy and Building. Volume 81. Pages 227-242.

Coch, H. (1998) "Bioclimatism in vernacular architecture". Renewable and Sustainable Energy 2. Pages 67-87.

Çorapçıoğlu, K., Çakır, S., Aysel, N.R., Görgülü, H.C., Kolbay, D., Seçkin, N.P., Ünsal, E., (2008). Determination of Regional Architectural Features in Rural Area Kayseri. TCE. Ministry of Public Works and Settlement. TAU Directorate. Vol 1-6. MSGSÜ Revolving Fund Management Directorate. Istanbul.

DURSUN D., YAVAŞ M., (2017). Cold Climate Sensitive Urban Design Approaches. Iğdır University Institute of Science and Technology. Magazine. 7 (2): 269-278.

Ergin Oruç Ş., (2015). Evaluation of Rural Architecture Diversity in Diyarbakır in Terms of Climatic Comfort and Energy Efficiency. Doctoral Thesis. Mimar Sinan Fine Arts University Institute of Science. Istanbul.

Ergin Ş., (2018). Role Of Climatic Factors In The Formation Of Architectural Identity In Rural Areas: The Case Of The Districts Of Çaldıran And Özalp In the Province Of Van. Cultural Landscape Of Van-Turkey. 184-206, E-ISBN978-975-2438- 33-0. Istanbul Aydın Unıversıty Publıcatıons. Istanbul

Gurbuz, O., (1994). The Geography of Van Lake Environment (In terms of Human and Economic Geography) (Unpublished Doctorate Thesis). Istanbul University Institute of Social Sciences. Istanbul.

Gurbuz O., (1996). Geographical Principles of Rural Settlements around Lake Van. International Symposium on Settlement and Housing in Anatolia through the Ages. HabitatII. Istanbul.

Karaca S., Sarğin B., Türkmen F., (2019). Investigation of Some Land and Soil Properties by Geographical Information System Analysis: Van Province Land and Soil Properties. Turkey Agricultural Research magazine. Siirt University. Siirt.

KILIÇ S., (2006). Van 2006 Culture and Tourism Inventory I Historical Values. Van Governorship. Van.

Kırbaş B., Quick N. (2016). Learning from Vernacular Architecture: Ecological Solutions in Traditional Erzurum Houses. Procedia - Social and Behavioral Sciences 216. 788 - 799. Elsevier.

Nguyen, Anh-Tuan. et all. (2011). An investigation on climate responsive design strategies of vernacular housing in Vietnam. Building and Environment. Volume 46. Issue 10. 2088-2106.

Olgyay, V., (1963). Design With Climate-Bioclimatic Approach To Architectural Regionalism. Princeton University Press. pages 6-175. New Jersey.

OLGYAY, V., OLGYAY, A., Lyndon, D., Olgyay, V., Reynolds, J., & Yeang, K. (2015). Design with Climate: Bioclimatic Approach to Architectural Regionalism - New and expanded Edition. Princeton University Press. OXFORD.

Özdemir, (2004). A Different Land Use and Rural Development Example in Eastern Anatolia Region: Dönerdere Village (Özalp-Van). Kastamonu Education Journal. Volume: 12 No: 1. 245-270.

Philokyprou M., Michael A., Malaktou E., Savvides A. (2017). Environmentally responsive design in Eastern Mediterranean. The case of vernacular architecture in the coastal, lowland and mountainous regions of Cyprus. Building and Environment. 111, 91-109.

Rapoport, A., (1969). House Form and Culture. Foundations of Cultural Geography Series. London.

Sarıkaya S., (2009). Solar Energy Sector Report. Eastern Anatolia Development Agency. Van.

Tanılır M. N., Uluçam A., Tanılır E., Arpa N, Kitapçı Y., (1998). Van in the 75th year of the Republic. Van Governorship Research, Compilation, Promotion and Publishing Center of Cultural Heritage. Ankara.

Uluçam A., (2000). Van Lake Surrounding Architecture in the Middle Ages and Later I- Van. T. C. Ministry of Culture Publications 2458-1. Art Works Series / 288. Turkish Historical Society Press. Ankara.

Van Province Clean Air Action Plan THEP (2016-2019) (2016). T. C. Ministry of Environment and Urbanization Van Provincial Directorate of Environment and Urbanization. Ankara.

Vellinga M., (2014). Vernacular architecture and sustainability: two or three lessons, in: International Conference on Vernacular Heritage. Sustainability and Earthen Architecture. Taylor & Francis. Valencia.

Yılmaz, M., (2012). 50 Yılda (1960-2010)Van ili"nde Kır-şehir Nüfus Değişimi. Doğu Coğrafya Dergisi. 28(17);33-56.

Url-1< http://http://www.mgm.gov.tr> date retrieved 14.07.2020.

Url-2<https://2.bp.blogspot.com/ date retrieved 15.07.2020.