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Islamic Azad University, Ardabil Branch
Anthropogenic Pollution Journal, Vol. 2(1), 2018: 1-11
DOI: 10.22034/ap.2018.538373

APJ
2588-4646

Analyzing the sustainable designing to reduce the negative human impact on rural environment, Case study: Oramanat of Iran

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Received: 28 November 2017/ **Accepted**: 20 January 2018/ **Published**: 30 January 2018

Abstract: With the advent of the industrialized and modern architectural technologies in rural areas, the existing vernacular architect has been diminished eventually. Using the modern and nonecological materials and technologies have caused the native human impact and a lot of damages to the rural environments. Using the vernacular and traditional principles is a great solution to reduce those negative human impact. Hence analyzing and extracting the sustainable vernacular principles is the key to achieve environmentally sustainable architecture.Thevernacular architecture of Iran in different regionshas diversity according to the various kinds of climate, culture, and age. These characteristics are unique in different regions. For example,architecture inthe central area of Iran is made of adobe, in the north of Iran wood is applied as the main material for architecture and in west of Iran due to the mountainous area, stone architecture has priority over other materials. In this paper, residential architecture of the western part of Iran especially mountainous villages has been studied. There are simple but wonderfulcontexts in Oramanat region(between Kurdistan and Kermanshah) in which different vernacular architectural indicatorscan be identified and recognized.These indicators embody the hidden identity of the stone architecture of Oramanat and now it is time to recognize them. In this paper, stone architecture of west Zagros will be identified.Research method in this paper is case study with a combinatory tactics. Differenttypes of rural housing with interpretive-analytic tactics will be studied and categorized. Then characteristic of each type will be represented. Finally the effect of livelihood, culture, climate, structure, material and nature on the design of housing is going to be described.

Keywords: Rural housing, Oramanat, Environment, Sustainability, Formative Norms.

[1]★This article is parallel to doing the Ph.D. Thesis Dissertation entitled **"Norms of Rural Housing formative, Case study: cold and Mountainous zone of Ardabil province"**, which is running under the supervision of Professor Mohsen Sartipi pour and in the Nazar Research center for Art, Architecture and Urbanism.

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1. Introduction: With the advent of the industrialized and modern architectural technologies in rural areas, the existing vernacular architect have been diminished eventually. Using of the modern and nonecological materials and technologies have caused the native human impact and a lot of damages to the rural environments. Using of the vernacular and traditional principles is a great solution to reduce those negative human impact. Hence analyzing and extracting the sustainable vernacular principles is the key to achieve environmentally sustainable architecture.

As the architecture of west of Iran is organic and has gradual evolution and thousand years of history, it has special architectural valueswhichare unique for the west of Zagros region and different from introverted architecture of central regions of Iran. By studying the past, we can find the emergence of the great civilization of Iran in many architectural works which later accompanied with the doctrine of Islam. When we talk of the great civilization of Iran, names such as Naghsh-E-Jahan square, Sheikhlotfollah mosque, Tisfoon palace, Anahita temples, Persepolis and many other names of famous places in the territory of Iran will come to our mind.It is essential to know that primary origin of this civilization has been in the west and north-west of Iran which would be proved by the existence of architectural works, belonging to the pre-Islamic era with the age of 10 thousand years (Pirniya, 1990). Oramanat region that is to be studied in this paper has a special stone architecture style. Oramanat architecture accompanied with its green mountainous region simulate the image of stairs leading to the paradise to the mind of the beholder. Houses of this region are built by stone and mostly by dry bonding and in stepped state. Hence, we can call it Hezar-Masoole in the west of Iran which meansthousands of Masoole. Mountainous, stepped or multilevel architecture are likely the most complete words that can be used for the architectural structure of this region. For the accurate identification, the architecture of Oraman in Kermansh and Kurdistan province is to be studied as a case study. Palengan and Oraman-Takht villages are the mostprominent cases of this architecture in Oramanvill of Kurdistan province for their texture, extent and establishment in the mountainside.

Fig.1 and 2. Stone architecture of Oraman's building, (authors)

To talk briefly about special features of this village, there exists liveliness, ancientness, beauty of the village texture, composition and interaction of the village with its environment, usage of material in hand and appropriate structure. History and richness architecture of this region has been ignored or paid less attention by researchers. In this paper, introducing vernacular architecture of this region is our aim. Achieving this aim, the goal, questions and the method of the research have been explained thoroughly at first. Then literature review and introduction of the region have been investigated. In following, after studying effective factors in formation of rural housing, we have analyzed and studied effective factors in the selected cases as follows. Finally essential conclusion has been represented.

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1-1 Research Goals

Identifying features of rural housing in west Zagros region according to different cases of Oramanat region is our goal but selection of different cases should be done in a way that these samples can be generalized to various types of residential buildings in west Zagros region. On the basis of different types, essential documents for typology of rural housing in Oramanat have been prepared.

1-2 Research Questions

Considering that the purpose of this paper is to investigate in the field of rural housing, attempts are made to answer these questions:

- What are the characteristics of houses in Oramanat region?
- What are effective factors in the formation of rural housing in Oramanat region?
- What is the relevance of rural housing to habitat and geographic territory?

1-3 Research Method

Research method in this paper is case study with a combinatory tactics. Different types of rural housing with interpretive-analytic tactics will be studied and categorized and essential documents of each type would be prepared. This research is an applied and explorative subject. Required data has been collected through librarial methods and surveying studies. For this research 40 samples of residential buildings of the region have been studied and analyzed and required results have been derived from studies (fig. 3).

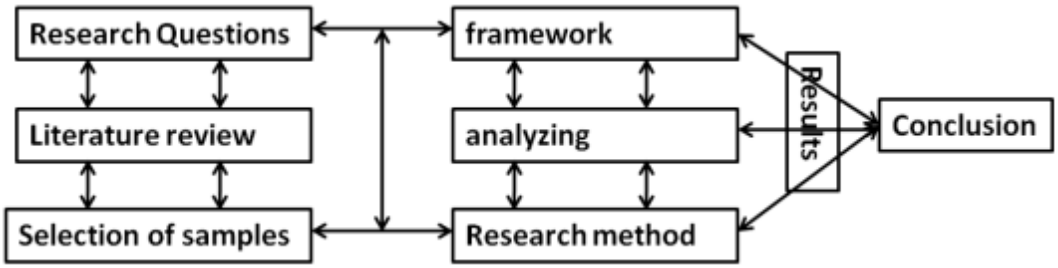

Fig.3. table of research method. (authors).

2- Literature Review

2-1 History Of The Research

In this research, types of rural architecture of Oramanat region in west Zagroshave been studied. This region is located in the border of Kermanshah and Kurdistan.Urartu were one of the first Iranian races which settled in this region about 1500 to 1000 BC and the first taken sign of architecture belongs to them. The first structure of architecture of Urartuis based on the column and beam mostly with religious type (temple); this structure was the base of architecture in this region for many years (Pirniya, 1990). According to the last data and the existing researches, the first settlements and villages in Iran date back to eight thousand years BC such as Ganj-Darre hill in Kermanshah province. Moreover first recognized civilizations in 3200 BC were the primary Elam civilizationstretching from the west and the south region of Iran plateau. Numerous cities have been formed in this region. Then Iranian civilization in the west of Zagros and Mesopotamia,at Middle and New Elam era, has extended andthennew methods in Iran architecture arises by the emergence of the Medesin the west and Persianpeoples in the south of Iran. Nowadays architecturalworks of the Medescan be found in Hasanlu hill (in south-west of Urumiyelake), Noshijan hill in the central of Lorestan and Gowdin hill of Kangavar (Mirdanesh, 1380). In spite of having long time of architecture, the architecture in this region was ignored after Urartusmostly because of the movement of government to the central part of Iran such as Esfahan and Ghazvin. In this research, Oraman–Takht region has been studied which is believed to be a central part in the past times and yet ancient traditions has remained in people's historical mind. Special ceremony, traditions,religious ceremonies, tomb of pirshaliyar and waterful springs of the village indicatestheimportance of the village in the past.

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Fig.4. Stone architecture of Oraman's building, (archive)

2-2 Oramanat Region

2-1-1 Geography of the Region

Horaman area is a mountainous region which has a special value for the Kurdsdue to its historical background. This area includes two northern parts of Pave city, part of Kurdistan province (Marivan and regions around it) and some parts of Iraq country. The part of Horaman area which is located in today Iran can be divided to Horaman-Takht and Horaman-Lehon part (fig. 5). The map exactly shows that Horaman-Takht is located in Kurdistan province and Horaman-lehonis in Kermanshah province.

Fig.5. Stone architecture of Oraman's building, (authors)

2-1-2 Climate of the Region

Horaman area is mountainous region with full of snow and rain. The annual amount of rain and snow is about 800-900 $_{mm}$. Most of this amount is showered like snow on the peak and the side of mountains.

2-1-3 History and Culture

Oraman village has ancientness in history because of the existence of thevestigeof numerous Atashkade (fireplaces) around it. Hence, it indicates that men of this region before Islam believed in Zorooster.Thisarea in the past was the territory oflocal rulers whom would govern on it by the authority, so the village was called Oraman-Takht, meaning Crown Center. The other narrative says thatOraman was a populated city in the past times which was considered as a government center in this area for Oraman's people. Oraman is pronounced "Horaman" in Kurdish. The term "Horaman" is composed of two parts "Hura" means Ahura and "Man" is a suffix means the land and place of God-Ahura Mazda.

"Hur" in Avesta, means sun, so Horaman means the land of the sun. Oraman-Takht is known as the Oraman title between the men of the region and annually Pir-E-Shaliyar ceremony will be held in it.The existence of temple of Pir-E-Shaliyar in Oraman-Takht villagebrings a great number of people to the village to hold ceremonies two times per year. Holding rituals and believing ceremonies as a moral character carry the depth meaningand

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2588-4646

provides the situation for the people to be present at the village.

2-2-4 Factors to Be Studied in Rural Housing of Oraman

Rural housing embodies complicated secrets and codes in spite of their simple design and construction, resulting from multi-thousand years history. Rural people understand through the time about what kinds of housing canbe a response to their primitive needs.These people with the samevision and livelihood live together for centuries, so nobody has superiority over another. As a result, no pride of rural people has led to not having trappings, extravagance, and surplus etc. in rural housing.So rural housing mostly has function and the avoidance of idleness principal is preserved in them. In this research, the most important features which are affected by the climate, topography of the region, livelihood and the economy of the region will be mentioned as below:

Establishment of building in the context and neighbourhood: the mountainous context of the Oraman village is interlinked, perfect and complete, so that ifone of the houses is removed from the context, its blank place will be felt clearly sounusual or unreasonable blank in the context has occurred.

Plan and its skeleton values: Despite the apparent simplicity of the rural houses, there is a complexity in the planning arrangement and the interconnection of human and livelihood spaces of the building which adopt with environmental and livelihood needs of villagers. Rural houses of this region are mostly two-storey buildings in which arrangement of human parts and livelihood parts are considered in two separate spaces.

Structure: structure of these samples has been studied due to their special stone architecture and also special technology of construction (dry bonding).

Climatic design: designing based on the climate is a method to reduce overall energy costs in a building. Buildings act as the first "line defense" against climatic factors outside the building. Neglectingthisprinciple in the rural housing of Oramanisim possibledue to the rain and snow in cold seasons.

3- Analyzing Cases

In this study, 20 samples of Oraman's rural housing according to the above features are used as case studies. Regarding the extent of the issueand limitations of the study, four samples of thosehouses are introduced as an example in this paper. So these four characteristics are examined in the samples in detail. Finally, the factors influencing the design of rural housing will be represented.

3-1 Introducing the First Sample of the Residential Unit

3-1-1 Establishment of Building in the Context and Neighbourhood

This residential unit has been located in the south- west of village in the secondary and compact texture, near a mosque and in order to access the building we should pass the passage next to the west side. We can indicate a mosque in the north-east side of the building.There is a diffuse texture in a stepped and compact manner around this building. There are three earth passages near the building in the north, south and west part (fig.6).

Fig.6. first sample of rural house, (authors)

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3-1-2 Plan and Skeleton Values

This building has been constructed in two floors in which the ground floor is under the ground level that includes spaces such as: two barns and three storages at the end and the middle. Also there are storage, bathroom and water closet in the first floor in the north-west part. The area of the ground floor is 74m^2 and area of the first floor is 65m$^{2.}$ There is aninterconnectionbetweenstorage of the first floor to the water closet with saloon, bedroom and kitchen adjacent to the storage. The ground floor has three entrances. In the western part of the building, each of the storage and barn has one entrance. However, the first floor has just one eastern entrance. The slope of the ground has been utilized properly in the construction of the building, as the two-storey structure enjoys enough light and radiative heat. Also the spaces for human and animals are separated.

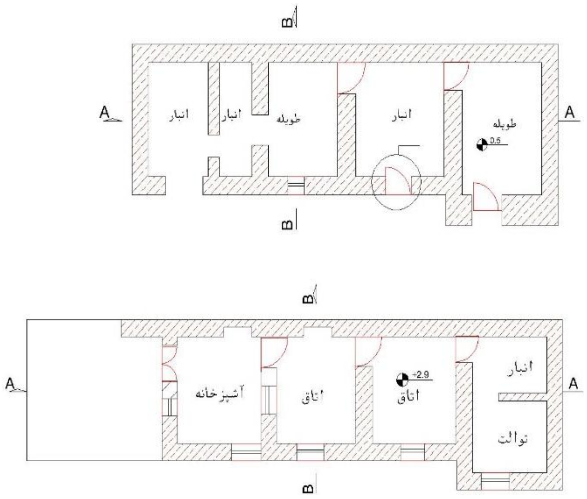

Fig.7. ground and first floor plan of the first sample of rural house, (authors)

The separation of human and animal spaces has led to the avoidance of the interference of the daily living spaces with the unsanitaryfunctions. The building has no courtyard as do the whole buildings of the village. The building is elongated on west-east axis.Openings due to the enjoyment of sunlight have been fitted in south and north. Different spaces of the house are interconnected.

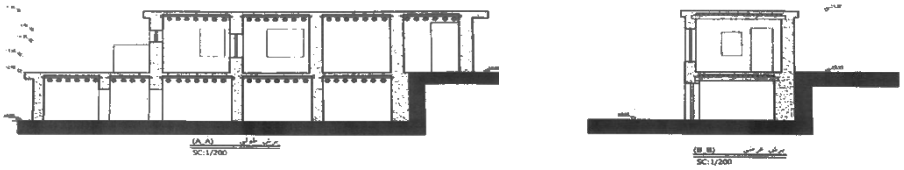

Fig.8. sections of the first sample of rural house, (authors)

3-1-3 Introduction of the Structure

Buildings of Oraman are mainly of materials in hand, indeed, due to the mountainous region, they have square stone (ashlar) which are put on each other with no bonding (dry bonding). This feature gives particular identity to the architecture of Oraman. While stone has been used for the walls, timber and wood have been used for spanning the lintel and roof. Walls are Load – bearingelements, maintaining the compression stress. Windows are of timber and steel. Roofs are flat with the mixtureofmudandstraw (thatch). The structure of the ceiling is with circular timbers coupled with supporting boards and occasionally branches of trees.

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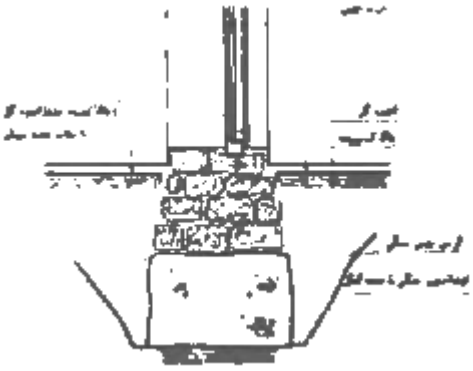

Fig.9. structure of the first sample of rural house, (authors)

3-1-4 Features of Climatic Design

This residential unit is built based on the high slope of the ground and in two floors with compact case and no yard to avoid the loss of energy. Harmony with the topography and texture of the village has led to enjoy sunlight in winter. So, if the building is elongated on the east-west axis, it will be exposing a larger collecting surface to the available radiation. Application of stone with high thermal capacity in walls,the thickness of walls and small windows avoid loss of energy. Barn is located downstairs, giving heat to the main space above it.

3-2 Introducing the Second Sample of the Residential Unit

3-2-1 Establishment of Building in the Context and Neighbourhood

The residential unit in the south of the village, in the middle of initial core is located down the main road near the Walnut orchards. Alleys and ways around the building are irregular and the relation of the village with main road is going to be possible through the steep passage from the north side of the village.It's a dense texture, making up the neighborhood of the unit which interconnect with others by stairs. Three earth passages pass over three sides of the house, the northern entrance is for the passage of animals, and however human entrance is at the east side.

Fig.10. the second sample of rural house, (authors)

3-2-2 Plan and Skeleton Values

This building the same as the previous one is constructed in two floors, 52 m^2 is the area of the ground floor, and however the area of first floor is 79 m^2. The ground floor includes the storage and the barn, separated by two distinct doors. The first floor includes living room and kitchen in the north part, bathroom and washing closet in the south-west part, corridor in the south part and the main entrance is located in the south-east part. There is no yard in the building. The livestock and human habitat are well separated and the spaces can easily be linked. The separation of these spaces caused residents to be respected. The building is elongated on east-west axis. Openings exist in the south elevation and there is no opening in other elevations except the entrance of the first floor (fig.12).

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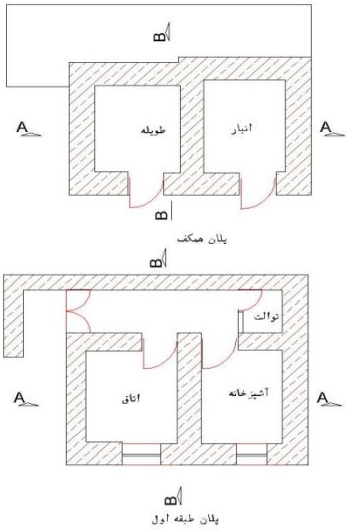

Fig.11. ground and first floor plan of the second sample of rural house , (authors)

3-2-3 Introduction of the Structure

Due to the overall image of the building, architectural and structural quality of the building is in an average. It was built of stone and wood. Lintel is of timber and straw which has been used for spanning the ceiling. Also they have windows of wood or steel. The thatch mortar is used forcoating of interior and exteriorwalls.Of particular importance in this building is the usage of stone by dry bonding.

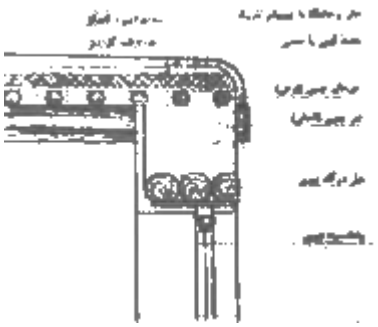

Fig.12. the second sample of rural house, (authors)

3-2-4 Feature of Climatic Design

In order to reduce energy waste, constructing high rise building is avoided and also the building has no yard. As flat land exists a little, the village is formed in the steep. Hence, a stepped village wasformed.The buildings enjoy the available radiation properly because of the stepped case of the village. Alsobuilding is elongated on east-west axis and there is natural ventilation, due to the placement of openings.Arrangement of openings with low width of the building maximizesthe enjoyment of heat and sunlight. Application of materials with high thermal capacity, the thickness of the walls and walls coated with thatch are effective factors in avoidance of energy loss. The reservation of the entrance space by walls surrounding prevents outside cool air from entering the building and the inside heat from wasting.

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3-3 Introduction of the Third Sample of Residential Unit

3-3-1 Establishment of Building in the Context and Neighbourhood

The location of this building is in the southern part of the village, in the secondary compact texture. This building exists at the high part of the village, dominating the whole of village. Neighbourhood units of the building are set of compact texture. Also there are irregular ways in the west and north-west of the building, providing access to it (fig.13).

Fig.13. the third sample of rural house, (authors)

3-3-2 Plan and Skeleton Values

This building is a two-storey building, locating in the step. The ground floor with 30 m^2 area includes a storage and the first floor with 54 m^2 area is allocated to the living room and kitchen space.Accommodation and livelihood space are separated. It also has no yard. There is no simple access to the service spaces. The human entrance is segregated from the entrance of the storage, adjacent to it, by the steep of the earth.The kitchen, locating higher than the room,interconnects the room with a door and two stairs (fig.14).

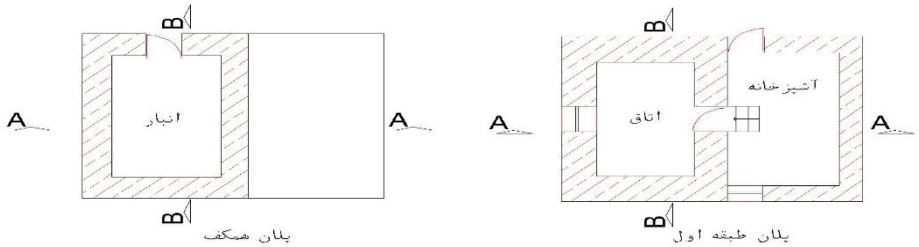

Fig.14. ground and first floor plan of the third sample of rural house, (authors)

3-3-3 Structure

Rubble stones and thatch mortar coupled with the circular timbers have been used for construction of the house. The applied materials are completely material in hand. The roof is flat which is spanned by circular timbers coupled with the foliage and branches of trees and sometimes with reserving boards. The structure of the building is load-bearing walls, transmitting the compression of the building entirely to the ground by the help of timbers. Also, topography causes the northern part of the building to be located in the heart of the earth. Uncut timbers have been used for the lintels and also timbers with straw for spanning the ceilings. Plastering is used for the inside coating and stone which has the role of load-bearing for the outside finishing.Windows and doors are made of wood. The quality of the structure and architecture is average.(fig.15).

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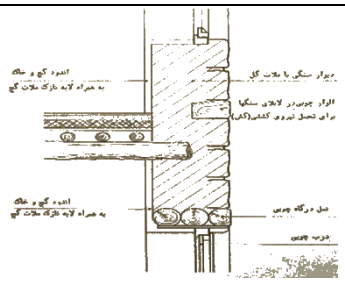

Fig.15. structure of the third sample of rural house, (authors)

3-3-4 Features of Climatic Design

By the aim of minimizing the energy loss, the building has been constructed compactly. Residential spaces have been put in the first floor, enjoying the conduction heat of the bottom floor. The elongation of the building is on east-west axis, so it enjoys radiation of the sun. On the other hand, stone walls with high thermal capacity and large width result in reduction of energy loss.

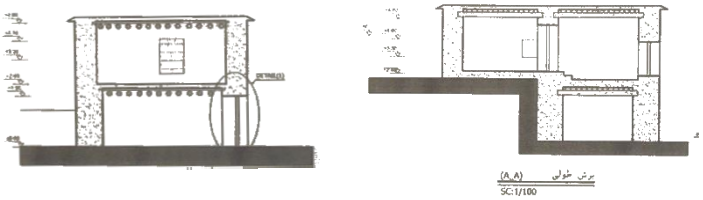

Fig.16. sections of the third sample of rural house, (authors)

4- Discussion and Conclusion

By studying the 40 samples (in which 3 samples analyzedthoroughly before), the most important notes of the architecture of villages of Oramanat can be broken down into the following heading and Using these traditional architectural principles can reduce the negative impact of development and reduce the adverse human effects on the natural environment:

Table1. reduce the negative human impact on rural environment

Factors affecting formation of skeleton of the buildings		Affecting skeleton	Quality of skeleton's formation of 1st sample			Quality of skeleton's formation of 2nd sample			Quality of skeleton's formation of 3d sample		
Total factors	trivial factors		desirable	proper	improper	desirable	proper	improper	desirable	proper	improper
Geography and environment	Rain, humidity, temperature, direction of radiation	Compatibility with climatic situation	100	-	-	100	-	-	100	-	-
	orientation of the building	Having optimized orientation	100	-	-	100	-	-	100	-	-
	steep	Compatible with the slope of the earth	100	-	-	100	-	-	100	-	-
materials		High quality materials, using technology and having proper design	80	-	-	70	-	-	80	-	-
		Low quality materials, limitation of spans- Inappropriate structure	-	50	-	30	-	-	50	-	-
Economy and livelihood	Economical effects	Separation of spaces, revolution of housing's patterns	80	-	-	90	-	-	90	-	-
culture	Cultural effects of the region	Optimized architecture, desirable image,	90	-	-	90	-	-	50	-	-

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4-1 Relation of Housing with Economical, Social and Cultural Influences

Economy and livelihood of the region affects the form of the housing.The planning arrangement of the buildings has compatibility with their livelihood; in addition, it facilitates their life cycle. The economy of the villages influence on the internal planning arrangement of the buildings and houses considerably. According to the dominant economy in the rural area, residential units have storages for their garden products or barn. In the figure given below, the effect of the livelihood and social factors on the internal planning arrangement is quite apparent.

4- 2 Climatic Design

Due tothe climate (cool winters and mild summers), the topography and roughness characteristics of the region,formation of villages mostly in the foothills, homogeneous housing is almost formed in this region. Climatic factors and mountainous area, the wind and…determinesthe orientation of villages, residential units and also the shape and placement of openings and windows. Also with regard to the climatic characteristics and in order to absorb more sunlight in cold seasons, the majority of residential units are south–north and windows are tall and embedded in the southern elevation. To prevent loss of heat energy, settlement patterns of most villages in the region is complex and stepped. Rocks as construction materials in buildings have high thermal capacity, preventing waste of interior heat and entrance of exterior coldness.

4-3 Materials and Structure

It should also be noted that soil is the most common building material in the villages of Iran.This material is used in various shapes such as barber materials, filler materials, mortar and powder.In some areas, villagers around the village have acquired a kind of natural soil that has incredibly interesting and efficient properties.Due to the abundance of rock in the surrounding of region's villages, the main material for the construction of the building is stone. Stone is not only the dominant material in housings of this area but also a structural element used in dry bonding case for load-bearing walls. In studying the residential units, stone has been used for the foundation and walls. Timbers and strawhas been used for spanning the ceiling. Openings are made of wood.Due to the usage of stone in the buildings of the village, Oraman village has received the nickname of "stone architecture"as its identity.

4-4 Relation with Nature

Residential architecture of Oraman village is made of material in hand such as wood and stone; moreover, the stone buildings of the Oraman have make them be considered as part of the mountainous nature. Compatibility of the building with the nature and also their minimum interference in nature has the main role in giving identity to the Oraman architecture.

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