Rural Housing Typology of Borojerd County Based on Structural-Physical Vernacular Patterns (Case Study: Kuschki-e-sofla Village)

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Abstract

The vernacular architecture of any region is an evidence of its valuable architectural, cultural and historical background. Efforts to identify and introduce this heritage can be the mainstay of addressing many of the cultural, social, economic, and developmental needs of vernacular settlements and to transfer architectural experiences and cultural techniques to other regions. Unfortunately, despite the rich history of architecture and culture in Iran, many villages have not received enough attention. Or, if they did, they have been forgotten, and this valuable wealth will be damaged and the quality of life of its inhabitants will be reduced due to lack of attention over time.

Borojerd County in the north of Lorestan province has unique rural textures that have been neglected despite the valuable architectural texture in its cold climate. Kushki-Sofla village is one of these kinds located in this region. So far, a great deal of the village has been damaged due to lack of conservation process. The purpose of the present study is to identify, introduce and document the local patterns of architecture and structure in the village of Kushki-Sofla. In order to achieve this goal, the research analyzes the existing typology of the village buildings. In order to collect the required information, the first phase is the library method. In addition, field study observation and semi-organized interview were used for data collection.

In conclusion, analysis showed that the spatial composition of the village houses consists of a three-sided and four-sided form. In the typology of the architecture of this village, the spatial circulation at the entrance by the corridors and the vestibule, the spaces between the porch and 'Mahtabi', the central courtyard, and the interior space of the spaces are the vernacular features of Kushki-Sofla Houses. They also used canvas materials such as clay, wood, thatch, and main building structures for building houses.

Keywords: Rural housing, Vernacular pattern, Vernacular architecture, Vernacular structure.

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Introduction

There are many villages in the geographical area of Iran which, due to their valuable historical backgrounds and monuments and architectural and cultural features, are unique versions of the local heritage that express the historical identity of today's people and are part of the national wealth. These areas represent the cultural, social and indigenous values of the country. Nowadays, despite the large number of such villages, many of them are not properly identified and suffer from issues such as the destruction of ancient and valuable buildings, reduced quality of life, distorted cultural identity of residents, the prevalence of modern aspects of urban life and increasing evacuation of rural areas (Pourrouhani, Pourjafar and Yadgar, 2016, 109). Identifying and preserving the precious heritage of vernacular architecture in general and rural architecture in particular, while being a kind of protection of the national historical assets of the country, helps us to discover the mysteries, symbols and signs that lie in them. It will also lead to implementing the sustainable principles of the past anew and preserving the identity and architectural originality of rural settlements (Sartipipour, 2009, 2).

The vernacular architecture of each region has been created under the influence of climatic, geographical and cultural conditions of that region and shows centuries of experience in the optimal use of materials, construction methods and climatic considerations. Ignoring this rich history can cause the disappearance of vernacular architecture and the experiences of those who practiced it (Ahmadzadeh and Maghouli, 2017, 87). The value and importance of these types reveals the need for their attention, care and restoration; because this attention can meet many cultural, social, economic and development needs of the region.

Studying rural architecture and vernacular patterns (Riahi Moghadam, 2008, 56), and preserving, regenerating and establishing life in these rural contexts will provide the ground to identify local cultures and past building technologies and transferring the cultural experiences (Jam Kasra, 2010, 65) in order to introduce the cultural originality and historical identity of valuable rural settlements at the national and international level and to upgrade the capacities of the village for further developments.

Research Questions

The aim of this study is to investigate the vernacular patterns of the residential houses of Kushki-Sofli village. In order to reach this important aim, the following questions are raised:

- What is the pattern of vernacular architecture and architectural features of village houses?
- What are the predominant building materials in the construction of residential houses in this area?
- What structures have the architects of the region used to build housing?

Research Method

This research is of applied research type. The method selected for this study, according to its purpose and requirements, which is to identify the vernacular patterns of rural housing, is a field study method. Having collected sufficient valuable samples and carefully examining each, the required information was obtained and the necessary maps were drawn by the authors. then by analyzing these examples, we tried to find the typology pattern and local architectural features in the historical houses of the village.

Research Literature

Rural Living

"A village is a form of social settlement and a natural and geographical unit, with a set of biological activities, which is directly related to housing and is able to provide all or most of its annual needs from within" (Sartipipour, 2009, 4). A village is a single phenomenon in the real world, and its cultural, economic, ecological and social components cannot be separated because its society is made up of people who has their own jobs, special products, defined relationships and beliefs, which are unique, and live in a specific geographical environment (Zargar, 1390, 31).

Vernacular Architecture and Rural Housing

Housing, as the main constituent element of rural contexts, expresses the quality of use of place and environment and the impact of economy, livelihood, traditions and norms

that are governing the rural communities (Sartipipour, 2005, 48). The architecture of a rural house is simple and very peaceful, but despite its utmost simplicity it is very complex. The simplicity of a clayey façade, which is monochrome and without contrast, is still eye-catching. The simplicity of rural architecture is visual, but its complexity is insightful (Akrami, 2011, 25).

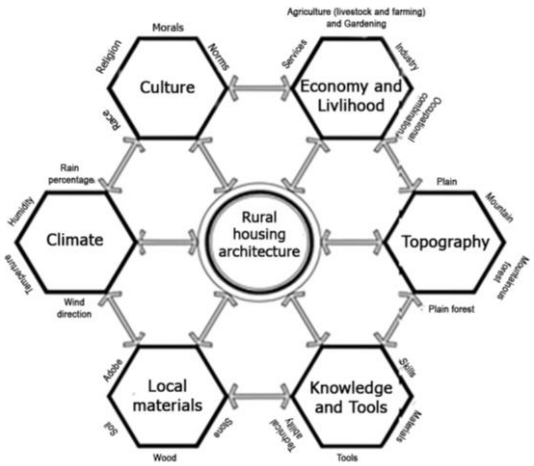
Rural life is a special kind of life that requires a complex type of housing called rural housing because not only must it meet the essential and daily needs of a life, but it must also meet the spatial livelihood needs of the villagers who carry out part of their economic activities at home.

One of the most important features of rural architecture is to pay attention to the design in accordance with the natural needs of the people and the environment and their daily activities such as the type of livelihood spaces of the people. Architectural examples of the coexistence of livelihood and living spaces in this type of housing is the depth of attention to people's lives and their needs that have harmonized the physical space with the story of people's lives and created it. Such a view of life and attention to needs and harmony with the natural environment has led to the formation of various forms of housing (Sartipipour, 2011, 3).

Vernacular architecture is well aware of the originality of life and environmental potentials, and instead of ignoring the needs of life and combating geographical variables, it is formed in harmony with it. Rural houses, which are good examples of this type of architecture, have relatively fixed and stable principles that are not easily subject to change, and its changes have taken place over a relatively long period of time (Sartipipour, 2011, 3).

Although vernacular architecture has undergone many changes during the history, it has been able to maintain its special identity, and since it is a valid identity of the people of a land, it reflects the customs, spirit, feelings, thoughts, beliefs, taste and art of them. In the formation of vernacular architecture, social and economic relations with the natural environment and cultural symbols are skillfully reflected in a way that at the same time simplicity and harmony is manifested in all of them (Dadkhah, 2005, 98).

There are three general principles of vernacular architecture: (1). The existence of coordination between the building elements, (2) Diversity in vernacular buildings and non-uniformity in them, and (3). Adherence to unwritten rules and regulations that are influenced by environmental culture (Salahi Isfahani, Mirza Ali and Sadin, 2017, 106) (Chart 1).



Ch1. Diagram of factros influencial on Rural housing architecture (Source: Movahed and Fatahi, 2013, 50).

Physical management of villages with historical value and social solidarity, along with balancing the necessary developments as well as value, are examples of cases and strategies that are also related to the concept of sustainability (Bazazzedeh et al. 2020, 2). In fact, vernacular rural architecture is built by people whose tradition and culture have influenced the body of architecture over the years by trial and error (Attarian. 2019, 1).

Rural housing is not only for living and shelter needs, but has also undergone changes in accordance with the type of culture, civilization and structures. In other words, rural housing has had different forms in different historical stages according to the type of economic, social and environmental structures (Mohammadi Yeganeh et al., 2017, 43).

Indigenous rural structures and materials

The traditional architects of each area have

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used the appropriate structure to build the shelter, according to the climate, environment and materials that were available in each area, and have designed the executive details to coordinate with the area and used the local structure. In fact, vernacular or traditional materials are materials that are prepared from the environment around the village and used in the construction of housing. Although it is generally believed that local materials lack the strength and durability necessary for the construction of buildings, and National Building Regulations do not recommend their use, there are durable materials with a variety of colors among them, and using them alone or in combination with new materials, can create diversity, durability and beauty (Sartipourpour, 2009, 24). The use of local materials to shape the environment and build shelters indicates the decisive role of nature in the formation and physical identity of villages (49). One way to preserve rural artifacts is to recognize and document their architectural, historical, and environmental features so that architects can plan based on the body, structure, and durability of rural buildings (Bakhtiari and Attarian, 2020).

Geographical Information of Borojerd Region

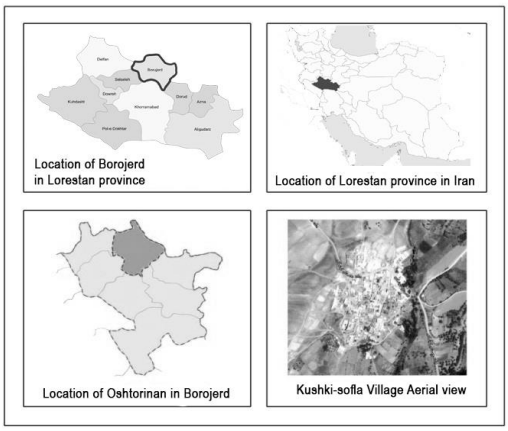
Borojerd city is 1701 square kilometers in area. It is located along the line of longitude, 48 degrees, 50 minutes east and along the line of latitude, 33 degrees, 55 minutes north. The area is 1573 meters above sea level and is located in the northeast of Lorestan province. The city has two central parts and Ashtrinan, where 71% of the population is urban and the rest are concentrated in villages.

Koushki-Sofli village is located in the northern part of Borojerd city at longitude 48.79, latitude 34.02 and altitude 2164 meters above sea level**.**

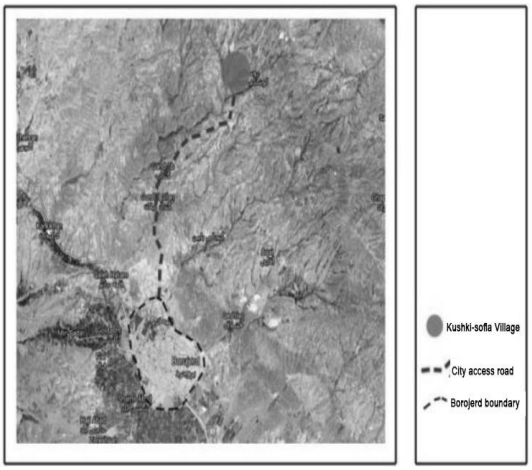
Koushki-sofla village has valuable texture and historical monuments. The existence of tourism infrastructure and the relative integration of ethnicity and local handicrafts is one of the capabilities of this village. The village is located in the western mountains of the country, one of the coldest regions. The average temperature in the hottest month of the year is more than 10 degrees Celsius, and the average minimum temperature in the coldest month is less than -3 degrees Celsius.

Climatic conditions of these areas are severe cold and low humidity in winter. There is a high temperature difference between day and night (Ghobadian, 2011, 98). Detailed information of this village, including general studies, historical elements, applications, passages etc., has been collected in Table 1. The framework of this table is taken from the book of rural histology of the country (Ahmadian and Mohammadi, 2009).

The access of the villagers to Borojerd city is shown in Figure 2. In Figure 3, the texture map of the village and its uses are graphically analyzed.



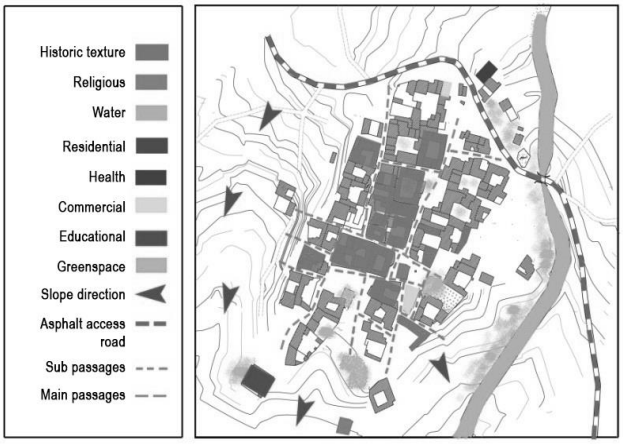
F3. Graphic analysis of Kushki-sofla Village (Source: Authors).



F2. Access of Kushki-sofla Village to Borojerd (Source: Authors).

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F3. Graphic analysis of Kushki-sofla Village (Source: Authors).

Pictures	Characteristics	Factors
	The population of the village in 1990 was equal to 314 people and 82 households and in 1995 it was equal to 226 people and 70 households. The predominant livelihood of the village is agriculture and animal husbandry, which includes: vineyards, walnut orchards and handicrafts.	General Studies
	The pattern of the network of passages in the village is semi-regular and non-closed. Passages are in the north-south and east-west directions. The entrance axis of the village is two passages in the north-south direction with a width of 6 meters and a length of about 130 meters. The other main axis runs parallel to the river and perpendicular to the two mentioned axes leads to the mosque and the old bath of the village and has no square. The height of the body of the passages is 3 to 7 meters and the body of the passages is formed only with residential units.	Network of Passages
	a) Religious use: The only mosque in the village has been built near the old bath, but it does not have physical centrality and attraction. The village does not have a Hosseiniyeh, and there is an Imamzadeh in the village. b) Commercial use: The only commercial unit of the village is residential houses that have dedicated a part of the house to this work. c) Health use: The village has an infirmary, health center, a doctor and a mortuary. d) Educational use: 17 Shahrivar primary school is the only educational center for the students in the outskirts of this village. e) Administrative use: The village has an Islamic Council and a Village council.	System of uses
	In the past, the drinking water of the residents of this village was supplied by water wells or aqueducts. The reduction of the water, and destruction of the well has made some problems in water supply or a short period. Currently, the village has water pipelines.	Water supply network
	In the past, due to the location of the village and the topography of the environment, the land slope and streams located in the passageway were used to repel surface water. Currently, surface water is discharged through tabulation, but in the passages, surface water is still discharged using the traditional land slope method.	Surface water drainage
	The level of green space in the village roads is low. The green space of residential units is also very small. The level of green space in the physical texture of the village is not noticeable.	Greenspace pattern in the village
	The main structure of the village can be classified into two general sections: a) The old structure of the village: includes valuable old houses that have value and details and architectural decorations that in some cases have been destroyed or semi-destroyed, Imamzadeh Abdullah and Hammami in the southern part of the village as well as old castles, which are for the Qajar period based on a local inquiry. These castles belonged to the village's Khan and were located in the middle part of the village. b) The new structure of the village: Includes new houses that are currently the residence of the villagers.	Main Structure of the Village

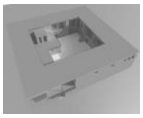
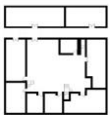
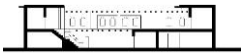
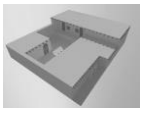
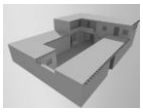
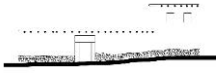
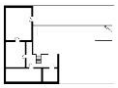
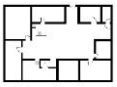
T1. Detailed information of Kushki-sofla Village (Source: authors).

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In order to study the types of architecture and structures in rural houses and to collect the information needed in the research, among the valuable examples that are located in the historical context of the region and have rich characteristics of vernacular architecture with durable structures, three samples were selected and their information was collected by field and survey methods. Other examples were not considered in the collection due to reasons such as high percentage of building destruction, abandonment or lack of cooperation and consent of the landlord.

The location of the selected houses in the map of the village is shown in Figure 4; and a summary of their information, including the site plan, facade, elevation and three-dimensional plan, was prepared by the authors in Table 2 as follows:

3D	Facade – Section		First floor plan	Ground floor plan	Sample
		Exterior elevation			First
		Section			
		Exterior elevation	—		Second
		Section			
		Exterior elevation			Third
		Section			

T2. **Information collected from the sample houses (Source: Authors).**

Typology of Rural Housing

Architectural features of village houses

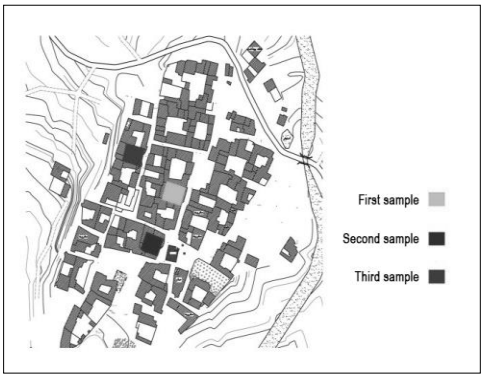
Rural housing is the most constituent element of rural areas. The organization and structure of rural houses and the location of spaces in them are affected by the environment and life of the rural community. In general, the principles and rules that are seen in the vernacular architecture of the houses in this village are as follows:

- Having a flat roof (bed and beam), due to access to wood materials and timber,
- Having a relatively dense arrangement in the dotted texture (a texture that include a set of buildings located separately from each other),
- Using semi-open space patterns, such as porches or vestibules, for transition between different spaces, connection between indoor and outdoor spaces, and heat control,
- Minimizing the outdoor area in comparison with the building area,
- Having two-floor buildings in general,
- Observing the spatial hierarchy for entering the houses by rotating the entrance and using vestibule and also porch in the historical part of the village,
- Having a central courtyard for connection between different spaces
- Using local materials for housing construction, including stone, brick and thatch, which have a high capacity and heat resistance,
- Using a simple design for housing in general Based on the information obtained from field surveys and observations, the details and characteristics of the native architecture of the village houses are as follows:

Interrelationship of building and earth

The creation of two-floor buildings in Kushki-Sofli village is the result of villagers' experiences. They place the living spaces on the upper floor and the livestock space, and the storage of equipment and products on the lower floor. This is done to reduce exposure to cold weather and provide the house with the required heat from the earth (Figure 6).

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F4. The location of the houses selected for surveying (Source: Authors).



F5. A passage in the village and the arrangement and density of houses (Source: Authors).



F6. The entrance of a cote in one of the village houses (Source: Authors).

Cote (heat control and transfer)

Using cotes is another technic devised by the residents of Kushki-sofla village to adapt themselves with the climatic conditions of the area. They create a space by digging channels in the basement to shelter their livestock from the cold weather. The metabolism of livestock in this small area omits the need for generating extra heat in winter and provides the living space with the required heat. In addition, cotes provide the desired temperature in summer.



F7. The interior of a cote in one of the village houses (Source: Authors).

Introvert Architecture

To provide privacy in the historical houses of this village, the interior space is not directly accessible from the outer passage, it is accessible through a porch, a corridor, or both. There was usually a common entrance to the courtyard for humans and livestock.

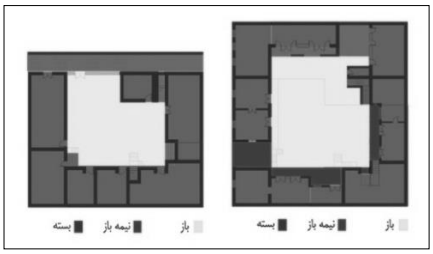
Courtyards are usually surrounded by buildings, and in a few examples, they are surrounded by walls. This type of planning provided the residents with an introvert architecture due to the climatic conditions of the region. However, most of the houses have windows and small terraces towards the outer passage for having a view of the village and improving the social communication of the residents in winter.

Courtyard geometry and form

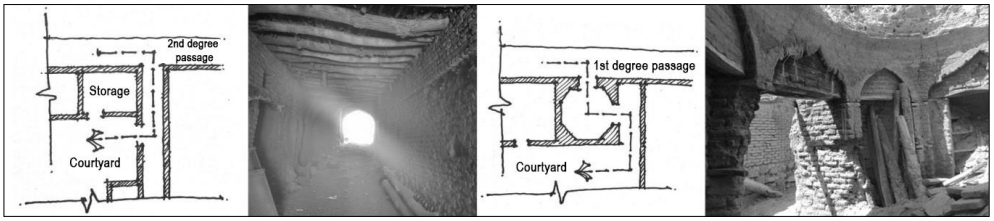
In the past, a courtyard was considered as an organizing element for rural houses due to its arrangement and centrality (Abron, Abbaszadeh and Askari, 2017, 47). The relationship between different spaces of a house was made possible with courtyards. According to observations and field surveys, the same pattern is followed in the houses of Kushki-Sofli village, and the central courtyard is a coherent and integrated structure with simple geometry surrounded by the house's different spaces. In the houses selected for this study, the central courtyard keeps its integrity and cohesive form despite many spaces and acts as a vital and essential element organizing transitions and providing the residents with ease in doing their everyday activities.

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F8. The relationship created by intermediate spaces between open and closed spaces (Source: authors).



F9. Observation of spatial hierarchy and rotation of entrance using a porch or corridor (Source: authors).



F10. Outside window and terrace despite introvert architecture (Source: Authors).

Spatial combination of the village houses

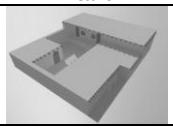
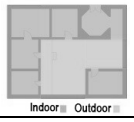
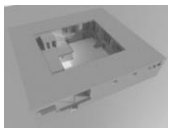
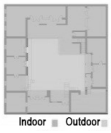
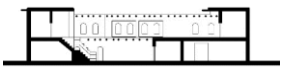
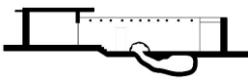
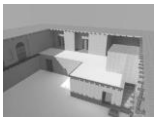
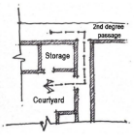
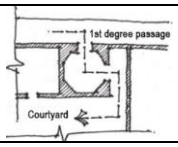
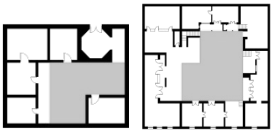
Based on the studied samples, the function of spaces in the houses of Kushki-sofla can be divided into three categories: living spaces, livelihood spaces and services. The existence of several indoor spaces helped the family to meet their livelihood needs. Moreover, due to the livelihood and the occupation of residents, which is mostly gardening, agriculture and animal husbandry, rural houses have a vast area. Courtyards, which are essential to every house, play an important role to connect different spaces. Surrounded by these spaces, they provide privacy for the residents. The general format of the plan in the selected houses has a rectangular courtyard in the middle, and the courtyard is limited to the indoor spaces from three or four sides. Findings of the research about the characteristics of vernacular architecture in the houses of the village are shown in table 3.

Typology of Rural Structures and Materials

Due to the deep connection between rural architecture and nature, the villagers, with accurate knowledge of the surrounding environment and the materials provided by nature, have made maximum use of their homes and minimized interference in nature. The use of local materials in rural architecture indicates coordination with the geography of the place and the use of its natural facilities. Geographical environment is a determining factor in the selection and type of materials (Sartipipour, 2009, 49-50). In the construction of houses in Kushki-sofla village, due to the climate, the most available materials, including clay, wood, stone, plaster, straw and brick, are used.

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No	Title		Picture	Graphic representation
1	Spatial combination	In one-floor type: Living spaces in the north, livelihood spaces in the south		
		Int two-floor type Living spaces in the first floor, livelihood spaces in the ground floor		
2	Interrelationship with earth - Sleeper wall leveled with the ground - Distanced from the ground with 2 to 3 stairs - Cote in yard			
				
3	Intermediate spaces	Terrace		
		Mahtabi		
4	Introvert architecture and privacy	Corridor		
		Vestibule and corridor		
5	Form and geometry of courtyard			

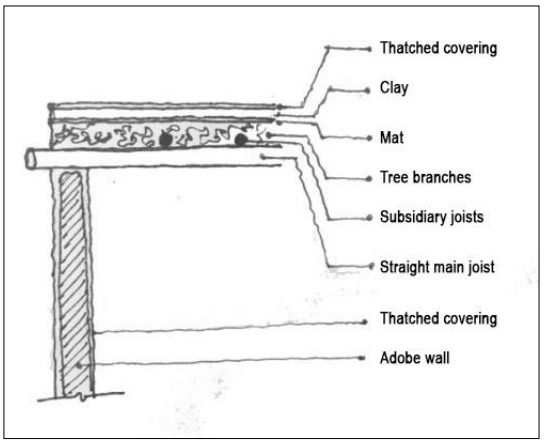
T3. Characteristics of vernacular architecture in the houses of the village.

Flat beam roof with thatched covering is the technique used in the houses of this village. This type of roofing reduces heat loss by absorbing maximum sunlight and makes snow removal easier (Figure 11).

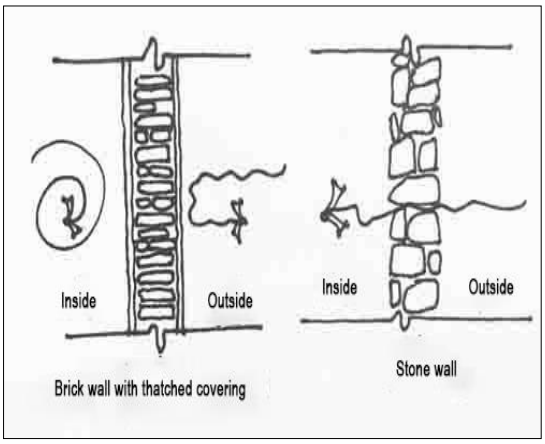
Adobe: Traditional architects used adobe and clay for walls with a thatched covering. These thick walls play a major role in bearing and transporting the load of the building. Also, using clay, due to its ability to save and control heat, provide comfort to the occupants of the house. Figure 12 shows the difference between the thermal behavior of a brick wall and a stone wall. In addition, the brick wall allows the implementation of details such as the installation of skylights, niches, shelves and ventilation.

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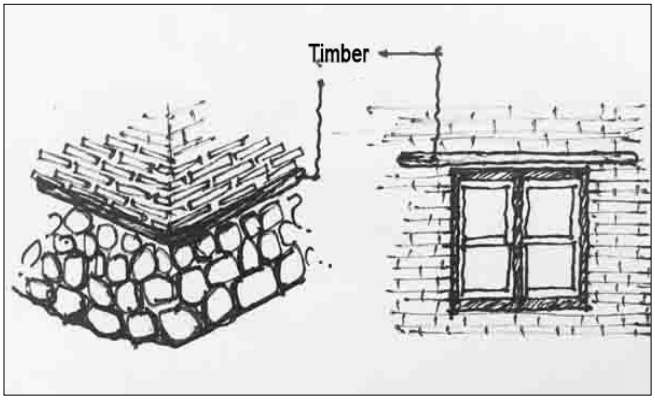


F11. Details of constructing a flat floor with wooden joints and thatched covering (Source: Authors).



F12. Comparison of heat transfer in brick wall and stone wall (Source: Authors).

Wood: Another local material that is used in the construction of houses in this village is wood. It is used for doors, windows, columns, covering of small openings, and niches. It is also used to cover the roof of interior spaces, which is made of high quality and smooth beams without knots. Wood is also located in the texture of walls due to the presence of moisture (Figure 13).



F13. Using wood in different parts of a house.

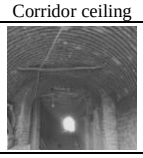
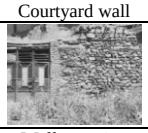
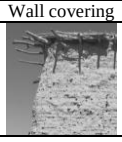
Brick: In order to cover the roof of the corridors and often the entrance of the houses, the brick arch and arch technique has been used. Brick decorations are also rarely found in some of the village's historic houses.
Stone: In the villages of this region, stone is used in foundation and sleeper walls, which are 1 meter in height. Moreover, the courtyard walls are made of rubble stone.

The research findings in the field of structure and ecological materials of the region are collected in Table 4.

Conclusion

Based on the survey and analysis of the information and plans of the selected houses in the historic texture of the village, the following results were found in answer to the research questions (Table 5).

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No.	Material	Application				
		Wall and window	Culomn	Ceiling	Lintel	Wall texture
1	Wood					
		Wall	Corridor ceiling	Entrance	Decoration	
2	Brick and adobe					
		Sleeper wall	Courtyard wall	Courtyard staircase		
3	Stone					
		Roof covering	Wall covering			
4	Thatch					

T4. Local materials used and their application in rural housing (Source: authors).

Rural architecture characteristics	Application
Local materials	- Materials are available in nature and compatible with climatic conditions - The most important material is clay, which is mainly used in the construction of load-bearing walls and has been a good insulator to conserve energy. - Wood is another widely used material in the region. It has been used to cover the roof of interior spaces, and to construct doors, windows, porch columns and lintels. - Although stone and brick are used less than wood and clay, rubble stones are seen in slipper walls and courtyard walls - Bricks are used to cover corridors and decorate entrances
Intermediate spaces	At the junction of the closed interior spaces to the central space of the courtyard, intermediate spaces such as porches and Mahtabi have been used. Moreover, in the architectural typology of this village, there is a spatial rotation at the entrance by the corridor, porch or both in order to observe the hierarchy of access and observe privacy.
Privacy and introvert architecture	- In the cold mountainous climate of the region, the thermal conditions of indoor spaces can be controlled by using heavy building materials. - In the spatial arrangement of the village houses, a central courtyard is limited to buildings from three or four sides.
Form and geometry of courtyard	The yard, which plays an important functional and connects different spaces of the house, has an integrated form. The location of the living spaces of the residents on the upper floor and the livestock space and storage on the lower floor separates these two areas and controls heat in the cold weather of this region.
Spatial combination of the village houses	The living spaces of the residents are in the upper floor and the livestock space and storage are in the lower floor
Heat transfer and control	- The principles used in the architecture of the village prevents heat loss in the various parts of buildings. - Heat is generated through natural ways as much as possible and is provided by the presence of people, cooking or livestock.

T5. Functional patterns of physical characteristics in Kushki-sofla Village.

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