

## **Investigation of the Structural Characteristics of Kandovan Village from Sustainability Perspective**

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### **ABSTRACT**

Today unlimited consumption of fossil fuels issues like environmental problems and limitation of resources and fundamental role played by architecture and urban buildings in wasting these nonrenewable resources have been manifested more than other periods. Current buildings consume resources more than their needs especially nonrenewable resources that affect negatively on environment and produce more waste .Significant amount of this energy is lost as a result of buildings heterogeneity with its climate that lost in order to heating and cooling of the environment and it leads to environment pollution .Undoubtedly those persistent and ever increasing effects will influence on sustainable future.

In this article the human friendly coexistence with environment and location of Kandovan village (it is registered in Iran national monuments list because of rocky architecture characteristics) are investigated. It is concluded that vernacular architecture is a sustainable architecture and it can be considered as an appropriate pattern for architecture today.

**KEYWORDS:** Kandovan ; sustainable architecture ; energy saving

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### **INTRODUCTION**

Sustainable architecture and designing compatible to environment is one of the main issues in design world today. It is probable that the aim of this designing is reduction of environmental damages and energy resources consumption and adjustment to nature .The main reason for selection of Kandovan village is it's special architecture (rocky architecture) originated from this region vernacular perspective that plays an important role in shaping of the village .This unique architecture manifests human relationship with nature in the best manner. In this village combination of nature and following nature and exploitation is seen. [1]

So from sustainability view point , this region's past architecture provides valuable context to investigation according to attitude towards human and environment and related strategies.

### **MATERIALS AND METHODS**

In the present paper. The research method is "analytical –descriptive". Attributive and field method have been used for collecting, analyzing the information of this research. Information collection has been done through publications, research studies, plans and internet sites in attributive stage. In field study stage, information collection has been done in the course of field observation and impression, and then designs have been studied and analyzed.

#### **Familiarity with Kandovan village**

Kandovan is one of the villages of eastern Azarbaijan province located in south of Tabriz in slope of Sahand mountains. This village dates to more than 850 years (Statistical center of Iran, 1375). The village height from sea is 2300meters and its climate is cold in winter and has nearly hot temperature in summer. Because of rocky architecture characteristics and it's special fabric. This village has been registered in Iran national monuments list. [3]

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Fig.1.Over view of the village Kandovan

Kandovan is one of the three rocky villages in the world that this property has led to its attraction.

Kandovan's architecture and fluidity of people life in its old fabric are considered exceptional since nobody lives in Cappadocia and Dakota of Turkey and USA. Today more than 117 households with 700 persons live in these rocks.

Kandovan's rocky architecture is more important than common architecture according to its history revitalization. In common architecture the main architectural frame is built by materials like lime, adobe and brick and spaces result of the main frame and building volume. While in rocky architecture the trend is reversed and the architecture begins from space.

The main characteristics of this village are creation of space and following region nature and form of *Karans* (cone-shaped rocks). The villagers have selected the practical, optimal and easy way to build and utilization of space. In Kandovan it is tried to use more by less space. [1]

#### **Kandovan village architecture characteristics**

Kandovan's rocky architecture creates world of beauty with its natural Karans and surrounding landscapes. Melted materials have thrown from holes of Sahand volcano and other volcanic mountains for thousands of years. These lavas have been piled during centuries and gradually a skin of Tuff rock with different resistance has been made.

Volcanic melted masses and lavas have been shaped by wind, storm, snow and rain in hundreds of years and the Karans have been established. Gradually Karan's less hard sections fell down and hard sections have been remained and current shapes have been made as natural miracle. [3]

Several grooves as natural water ways separate the Karans in this village and it has made natural alleys. Wooden bridges have been built on some grooves that connect the Karans to each other.

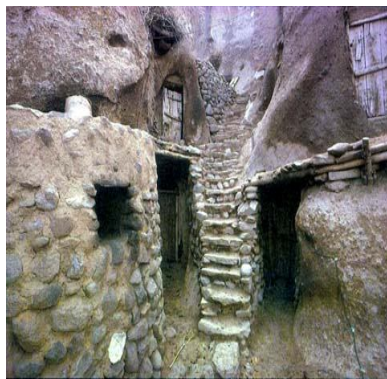


Fig.2.Natural valleys



Fig.3.Bridge between Karans

The Karans have been expanded in east and west directions and they are concentrated in east. West Karans have gradually destroyed or they are semi destroyed because of insufficient preservation. Since people live mostly in east part because of less solar radiation in west part while east Karans are used due to sun radiation and this part is undestroyed. [4]

The Karans consist usually of two floors. In some cases three or four floors are seen. Upper floors of the Karans are connected by beautiful steps built from the Karan itself.



Fig.4.Steps lead to upper floors

Because of high thickness and diameter of the Karans , lighting of lower floors is difficult .So , lighting facilities are located in upper floors. Windows are made of wood mostly in checkered shape and there are small parts of glass among them. Although reduce heat exchange between internal and external sections small openings are positive aspects but shortage of sufficient light and ventilation inside rooms are considered as their weak points.



Fig.5.An example of openings

The Karan's first floors are used mostly for preservation of animals because of less light entering and being wide spaces and using heat provided by animals. Second floors are residential.

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1-Karans are locted in direction of river and surrounding hills and the main village direction is vertical on south west. So from climatic view point and solar radiation direction , valley and river ,the Karans are in good positions.[3]



Fig.6.Location of kandovan village

2-since these Karans resist on climatic factors like sun beams , wind , rain, humidity , snow and also earthquake they were less eroded and the possession has been continued from generations to the next generations during thousands of years.[3]

3-thses Karans are optimal for cold weather of the region since sometimes the thickness of walls of the houses reach to two or three meters that act like thermal insulation and energy resource saving. For this reason the temperature oscillation inside the Karans is less and winters are warm and summers are cool.

4-Kandovan residents use the Karan's basement as stable and upper floors are residential so this trend causes to reduction of contact to external cold and reducing thermal loses.

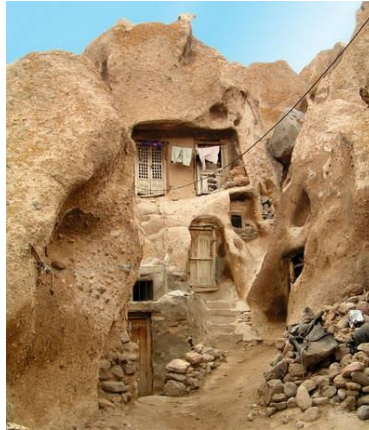


Fig.7. View of a house

5-The ratio of outside areas in the Karans are less than inner areas (SVR) that it is appropriate for mountainous climate. [3]

6-Because of manner of placing houses next to each other, the cones surface causes to wind breaking. And shape of doors and windows in inside walls prevent entering rain and snow in inner spaces.

Smallness of openings and also relatively small space and short ceiling inside the Karans , are effective in prevention of thermal exchange between interior and exterior. And it causes to easy heating of inner spaces.



Fig.8.interior view of a house

7- Since people have emptied the Karans for residency, their materials are renewable and easy for transportation and they are less expensive.

8-The main property in creation of space is compulsory following of nature and the Karan's form. In specification of these spaces the practical and easy way has been selected. The created spaces in the Karans merely meet functional needs and extra and unusable spaces have been avoided. The model of these spaces is compatible to human size. [3]

## Conclusion

Because of compatibility to climate and energy resources in establishment place and utilization of non fossil and renewable fuels like solar energy for heating in winter and also using wind energy for

ventilation and cooling of inner spaces and compatible designing with site and climate in direction to respect environment and energy saving and preservation in construction and using vernacular materials and correct orientation of buildings, these vernacular monuments are sustainable and they can be considered as an appropriate pattern for today architecture.

It should be pointed that Kandovan village's old fabric is one the beautiful and unique landscapes among Iran historical villages and it is only alive rocky village that encounters to serious threats by new constructions that are different from old fabric.

Unique Karans have been surrounded by coarse electrical wires in crude way and because of increasing village population the residents have to imbalance the nature by construction of houses made of adobe and cement and this constructions threatens sustainability of the village and it needs to serious action.



Fig.9.Heterogeneous constructions

### **Acknowledgment**

This article is based on M.A.dissertation by the name of “Research Center of Solar Energy With Trend of Intelligent Architecture” that has been developed with Dr Shahryar Shaghghi , PH.D. in Islamic Azad university , Shabestar branch , Department of Art & arch , Shabestar , Iran.

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