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### Analysis of Stability Patterns of Iran's architecture in Yazd's Traditional Houses

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#### ABSTRACT

In order to create a sustainable and proper environment for human life, Iranian desert architecture has found principles and methods that not only do not enforce damage and destruction on the environment, but also, beyond that they play a role as the factor that perfects it. Reviewing features of physical design of desert architecture and executive methods and materials shows that in architectural design, in addition to using environmental potentials, also prevents destruction of the environment and is an obvious evidence of sustainable architecture. Yazd province is one of the desert cities of Iran and due to its hot and dry climate, its architecture now has some different features which provides the conditions of easement for the users, both from the mental dimension and physical dimension. Architectures of this land, with subtlety and intelligence, have used particular tricks in creating various and sometimes unique architectural elements, so that they would provide the condition for easement and comfort of human life in the desert. Despite the time that has passed, these buildings are still standing and they have responded to the residents' environmental, cultural and economic needs in the best way at their time. And therefore, the principles governing them can be indicative of the principles of sustainable architecture. This article is seeking to understand repeatable values and principles governing the architecture of Yazd's traditional houses as a sustainable architecture and extracting its repeatable features, in the respect of achieving the goals of sustainable architecture, is one of the purposes of this article. Thus, by considering the traditional houses of Yazd as an evidence of sustainable architecture, we are after the answers to these questions: What are the patterns of architectural sustainability in Yazd's traditional houses? How can these principles and repeatable values be extended in today's architecture of Yazd's houses? The method of this research is based on library studies and field researches and it has a descriptive approach. The results obtained from this research lead to understanding of the available repeatable values in the architecture of Yazd's traditional houses (as an evidence of sustainable architecture).

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#### INTRODUCTION

*Statement of the issue:*

What has been a tradition within the architectural culture of the past is in front of us as a lifeless configuration today; and naturally, today's societies, in order to discover and use past values, are forced to search and explore to recognize the unfamiliar and forgotten values within them.

Sustainability of many of the desert's traditional buildings, in terms of socio - cultural, economic and environmental matters, is one of the values that can also be extended in today's architecture of desert houses.

This article is seeking to achieve the items below by considering the traditional houses on Yazd as an evidence of sustainable architecture:

- Reviewing the patterns of architectural sustainability of Yazd's traditional houses
- Recognizing repeatable values and principles governing the architecture of traditional houses of Yazd in order to use and extend these principles in Iranian contemporary architecture

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*Purposes of the Research:*

Sustainability is a concept that is mostly used as the degree of value of a method and is a repeatable process. With this approach, understanding the repeatable values and principles of local architecture is very valuable. Obviously, traditional architecture responded to the needs of its own time and repeating it is futile. This article is seeking to understand repeatable values and principles governing the architecture of Yazd's traditional houses as a sustainable architecture and extracting its repeatable features, in the respect of achieving the goals of sustainable architecture, is one of the purposes of this article.

*Field of study:*

Given the various available samples in Yazd, the field of study is limited to reviewing houses in the Pahlavi and Qajar period which had ventilator and basement.

*External validation of research:*

If we accept that shape, including natural and social phenomena, belongs to the outside world and has special specifications and a particular energy and that energy can convert anything in something else; and we also accept that man has responded, in preparation of the build space by using shapes with environmental constraints and facilities in the form of application to his needs, including physical or nonphysical, and necessities, we can claim that local architecture is applicable in any section of history, of course with pervasive physical and nonphysical sense.

*Research method:*

The method this research is based on library studies and field researches and it has a descriptive approach. The results obtained from this research lead to understanding of the available repeatable values in the architecture of Yazd's traditional houses (as an evidence of sustainable architecture).

*Introduction of features of yazd's architecture:**Climatic characteristics of Yazd:*

Hot and dry climate in summer and cold and dry in winter, very little rainfall and humidity, very low vegetative cover and large temperature different between night and day are among the general characteristics of Yazd's climatic conditions.

*City texture of Yazd:*

Generally, all of the living spaces in this region are totally protected against adverse weather and especially undesirable wind. And using desirable wind and sunshine is also done by using special arrangements. City texture is tight and the buildings are attached to one another. The allies are narrow and are aligned along in the path of a broken line with relatively high walls.

*Form of the Buildings:*

Buildings in Yazd are completely introverted and enclosed. And all of the buildings, except for baths, have a central yard. By placing openings facing the relatively humid and temperate space of yard and barring the external wall of the building, the connection of the inside living space with the unfavorable outside space is cut out and a small climate for man's conform in the dry and hot climate of the region is created. Arches are often arched and domed and brick walls are also build with large thickness in order to bear the heavy load of these domed arches.

*Introduction of the physic and space of yazd's houses:*

Yazd's architecture compared to its surrounding cities is like largeness of the capital of a country compared to its other cities. Although we can observe some similarities in using some of the architectural elements of Yazd and other cities surrounding it; but in Yazd, by skilled architectures, each of the architectural elements have been worked on and in total, each element has reached a high degree of perfection and development of its own.

From a historical perspective, each of these elements has a long history as well. In Yazd's history book, various house elements have been mentioned including platform, spring house, coastal water, ventilator, parlour, "Shah Neshin", and a wooded garden in beautiful shapes and in the comprehensive Jafari book, the name of elements such as: "Tehrani", pergola, awning, "Fakhr Modayyan", mirror hall and vestibule are seen. In the following part we will refer to architectural following elements and spaces:

*Yard:*

The yard of Yazd's houses is a perfect symbol of introversion. In Yazd, yard is a completely different environment than the outside space. In thus small garden, the residents have created a delightful environment by

planting beautiful trees and flowers that are familiar with Yazd's environment, alongside with a long pool. In addition to this, yard is an important element of organizing various spaces in different seasons of a year. Among other features of yard is its communicative – movement role.

#### *Hall:*

Hall or platform is a semi-open, important and mutual space in all of the houses in Yazd. This element has a history of several thousand years in Iranian architecture and it is seen in the local architecture of most of the regions of Iran, from Lorestan to Kordestan and from the north to the center and south of the great Khorasan. The usual considered shape for the hall is an elongated rectangular shape. In some considered samples, two walls have been placed in its side which is overlooking the yard and the entry stairs to the hall are besides these walls.

#### *Ventilator:*

Yazd's ventilators are different from other areas of the province both in terms of shape and also in terms of size and dimensions. Perhaps we can consider the degree of significance of Yazd's ventilators compared to other areas of the region like the houses of Yazd with those regions.

Ventilators of this city are mostly one of the signs of royalty and individuation. Therefore, people who were financially able to build the ventilators attempted to establish it for assertiveness and finding a social image and being prominent in the society so that in addition to taking advantage of a pleasant summer space, they would be famous as elite and affluent class of the society as well.

#### *Entry:*

The entrance of the house at all times and even in the simplest houses invites people to enter. The height of entrance is equal to the earthen wall or it occupies a part of the height of the wall. The surface of the entrance is usually decorated with designed bricks. The vestibule is also made in various shapes and it is the only part which is far from the yard in some cases.

#### *Room:*

The rooms were used by considering their usage such as bedroom, living room, hall in seasonal reception. The types of rooms were two-doors, three-doors, five-doors, "Tehrani" ("Arasi"), "Goushvareh", parlour and stool of the house.

#### *Basement:*

The most important space of the house during the hot and unbearable days of summer is the basement. In houses without the garden pit, all or a part of the spaces below the ground floor has been occupied with basement. The connection of the basement and the ground floor is made through stairs inside the yard.

#### *Concept of sustainability:*

In Persian, the word sustainable means fixed, stable, permanent, lasting, durable, constantly stable, forever and sustainability has been used in the sense of stability, form and strength.

Sustainable architecture is an architecture, which is complied with the economic, social, and natural environment, is the process of creating a space in which the natural sources are damages as little as possible during the time of building and exploitation.

The principles of formation of sustainability have been defined as follows:

- Using nature's solutions
- Compliance with the environment instead of changing the environment
- Coexistence of the artificial environment with the natural environment
- Total unity and autonomy of components
- Non-renewable energy storage
- Recycling of construction and building materials
- Respecting the substrate of the plan
- Using all of the above principles together simultaneously

Three basic principles for sustainability in architecture are mentioned: careful consumption of resources, by reducing consumption, it deals with the reusing and recycling natural resources used in the building; Designing according to the cycle of life, which is a method that mentions analyzing the process of constructing a building and its effects on the environment and finally, Human Designing, which focuses on the interactions of man and natural world.

Traditional desert buildings are considered as sustainable buildings, because they meet their needs about water and energy in the site and not only are they compatible with their site and climate, but they also share the changes of the environment. They work without pollution and they don't produce any kind of waste that is not

useful for another kind of building process or can't be used in the environment directly. They provide health and happiness of the residents in a unified ecosystem and lead to promotion of the environmental qualities as well.

*Reviewing the sustainable patterns in the architecture of yazd's traditional houses:*

Three dimensions of sustainable architecture include social aspects, environmental aspect and economic aspect and each of these following dimensions will be reviewed in the architecture of Yazd's traditional houses.

*Environmental aspects:*

What is meant by environmental architecture is that, building's capability for being in accordance with environmental, atmospheric factors and converting them to spatial qualities and comfort and form are focused on. Environmental sustainability is reviewed in the considered samples in two areas of their link with nature and climatic design.

*Link with nature:*

An architectural piece is mixed with the earth from the time of being born and from the moment that it will have to take its first steps to become physical: it receives water from the earth and after altering its appearance and chemical – physical content, it returns the water to different extents, it faces the breeze and turns its back to the winds that bother it. Mixing with nature comes with following nature and also exploiting it. Establishment in a natural environment, whether due to the compliance and respecting it and whether in association with a series of beliefs which are formed from the ancient culture and adventurous history of the born land with grace and elegance [1].

In mysticism, the belief is that water, wind, earth and fire are the basic elements that form our environment; therefore, in Iranian architecture their presence is always obvious.

*Climatic design:*

In review of traditional houses of Yazd, from a climatic perspective, the following principles can be concluded:

- First principle: reduction of reflex of sun's heat by using green space: the rate of reflection of sun's heat from a green space is considerably lower than dry and burning soil of the desert. Architectures are aware of this issue and they have covered the space surrounding the houses by using trees and shrubs. Presence of green space affects the dry heat and cold of the region and considerably moderates the temperature.
- Second principle: Trend or direction: direction of the houses that are being reviewed compared to the row trend is the reason that a proper light is provided for the houses and on one hand, the building is protected against the improper winds and on the other hand, it is able to use unpleasant winds.
- Third principle: evaporative cooling: third principle that has grabbed attention in architecture of houses is dryness of air and possibility of cooling it with the help of evaporative cooling. This principle shows itself in using a garden and water pool in the houses. Passage of warm and dry air from these surfaces leads to the consumption of the warm air for evaporation of water droplets and consequently making the water cool and humid. Also in the spring houses, simultaneous presence of wind and water through the presence of ventilator and canal waters help the evaporative cooling of the environment in the summer heat.
- Fourth principle: the fourth principle is directing the yard's pleasant air inside the rooms. This matter is possible with the help of pergola. High height of spring houses is the reason for which warm air goes up and is sucked out through pergola. Therefore, by creating a negative pressure in the space of spring houses, a cool breeze from the garden will replace it and will create a pleasant condition.
- Fifth principle: directing wind toward inside of the closed spaces is done by using ventilator. Cool wind enters through ventilator's opening due to the positive pressure, it would be blown to the space of rooms and it would be cooled with the passage of water due to the evaporative cooling. At night time or at the times that wind is not blowing, ventilator acts like a solar chimney and the cool air of garden would be sucked into the rooms.
- Sixth principle: maintaining the coolness of the room's air in summer and maintaining its warmth in the winter will be achieved difficultly in such an unsuitable environment. Using thick brick walls and inevitably brick arched roofs, which are the materials that are only available in the desert, helps. Due to its property of accumulating heat in itself and gradually conducting it, it acts like a capacitor for maintaining warmth or coolness inside the room and presence of the least openings, including door and window, has not neutralized this property of the materials. High height of rooms, which is the result of the roof's curvature, has kept a large volume of air in itself and prevents rapid cooling and heating of the room [5].

*Cultural and social aspects:*

Behind this principles lies the human and self-sacrifice ideal of respecting social lives of men. With a deeper reflection, we find out that this principle is deeply rooted in the need to keep the chain of elements of ecosystems, because survival of life and mankind depends on their existence.

Cultural and social aspects are based on evaluation of human personality and have become known as follows:

*Introversion:*

One of the beliefs of Iranian people is the private life and its reverenc254e, and as a result of it, organs of building are organized around one or multiple main hall and separate the building from the outside world [4].

Introversion is seeking to protect the environmental privacy in which the physical conditions have reached a harmonic and transcendental order in order to reach their essence and finding a calm mind and original easement inside.

*People-orientation:*

People-orientation means respecting proportion between building organs with man's organs and paying attention to his needs in the work of construction [3]. Given the usage of brick and mud in the architecture of houses which are the local materials of the region, inevitably the shape of roofs is curved and as the result of this curvature, the roofs will have a high height. This high height are effective in creating the conditions of heating comfort of the spaces, in a number of houses that are being reviewed, the height of some spaces have been made proper for men by creating fascia in the man height o by using "Karbandi".

*Flexibility:*

The concept of flexibility in the Iranian traditional houses has been defined in three kinds, variability (multi-functional spaces), versatility (seasonal daily movement) and changeability (differentiation and integration). Each of these kinds in the evidences, that are being studied, will be reviewed in the following section.

a- Variability: variability is the most basic and effective way of reaching flexibility in designing an Iranian traditional house. Variability in main and servicing spaces of the house in the preliminary layer of the surroundings of the yard is more than communicative and service spaces. Functional and spatial variability of spaces such as spring house, three-door space and etc. was created in proportion with family's daily needs and using each space in various times. Three-door room was usually used for private living room o the family and works such as carpet weaving and sleeping. Spring houses, in addition to creating a delightful environment in summer, had a role in dividing the space in summer houses and all of the spaces in which people lived in summer had access to them.

Elements such as shelves, in addition to making the building lighter and reducing the thickness of the walls, provided a proper place for putting various object of life. Elements such as door and window were responsible for variable functions such as possibility of passage ad connection with yard and bringing light to the inside space at the same time.

b- Versatility: versatility is the ability of coordination of a space with the new required condition. In the houses that are being reviewed, by following the map, appearance and spaces of the house were made possible by a general pattern of formation, adjustment of daily and seasonal life with adjusting house's vertical and horizontal connections and using various spaces in various times of the day and in various seasons. Spaces such as spring house, summer house, balcony and roof top make accordance of the house with various living conditions possible. The concept of migration in traditional houses represents versatility of the traditional houses in the best way.

c- Changeability: changeability means the ability to respond to the growth of family in various stages of life. Changeability can be obtained by the two ways, adding the available infrastructure in the house or separating its spaces.

*Economic design:*

In fact, economy has infrastructural impacts on architecture, when society and environment have superstructure impacts. In the traditional consumption system, there is no waste or something that would have to be thrown away in nature and the cycle of life constantly continues without an element exiting it.

*Avoiding futility:*

Islamic culture, with recommending moderation and proper and suitable use of God's blessings, has prohibited its followers from doing futile and useless things and also from creating entertainment objects that lack a proper usage and are below human's dignity [4].

In some of the reviewed samples, since partitioning structure is fully done and cannot be shortened due to architect's desire, by adding "karbandi", it has become shorter, proper and people-oriented. So "karbandi" has not been used as decoration, but it is a part of building's fundamental work.

#### *Using local materials:*

Producing construction materials in traditional buildings has been done with the least damage and harm to the environment and with the minimum consumption of fossil energies, lack of creation of hard building garbage that can't be absorbed in nature. The type of construction materials consumed in the studied buildings is mostly bricks which are usually obtained from the soil resulting from excavation of the product and straw and digging the base of the building. And in combining with other materials, which are sometimes among agricultural materials, they have been used in construction. In other words, providing materials is from local resources and they are all considered as local materials.

#### *Recycling and reusing buildings:*

Recycling and reusing buildings can also be considered as another tradition of Iranian architecture and development of cities, especially desert. "Kamva", which is the debris obtained from destroying earthen buildings, enters the production cycle by the farmers and as the finest agricultural soil, it is born again. Simultaneously, old mud of the gardens is also used for producing brick and creating architectural spaces. This method of encounter is in fact a result of understanding natural processes. Since there is no waste in nature, side product of each organism turns into another feed. In other words, natural systems are composed of a closed cycle. Making the natural processes and cycles visible revives the designed environment. This principle is in fact considered as a significant principle in sustainable designing which has been expressed explicitly in Iranian architecture.

#### *"Niaresh"*

"Niaresh" is the static knowledge, technique construction and building (science of materials). This system includes essential dynamic and static needs of a building and includes all the done attempts in construction, for compliance with the available levels of knowledge and technology.

Given the materials used in the reviewed samples (brick and mud) structure of the building is affected by these materials and all of the roofs are curved which is the best structural response.

#### *Introduction of repeatable values:*

Repeatable values in the reviewed sample can be reviewed generally or in details.

#### *Preliminary provisions:*

- Accurate programming and management and design, in accordance with economic, social and environmental dimensions
- Site programming (establishment and application of the land in sustainable design, locating in order to reduce the severe environmental impacts)
- Comfortable, healthy and environmental physic in the building
- Moderation of energy and using renewable energies
- Materials and structure (using green facilities and materials)
- Paying attention to the minimums
- Control and maintenance
- Paying attention to the culture of the consumers

#### *Secondary provisions:*

Environmental design	- Paying attention to semantic features of nature in designing buildings in order to harmonize the building with nature and making the built environment meaningful
	Covering the outside environment of the building with green space and vegetative cover appropriate for moderating the temperature and reducing temperature fluctuations
	Direction of buildings towards "Ron Kermani" in order to benefit from desirable light and wind
	Using garden and water pool for evaporative cooling
	Creating height difference in the roof top in the direction of sun's movement for shadow in various times of the day
	Increasing the height of the building in order to suddenly reduce or increase the temperature
	Using proper shadings for lack of light's entrance in summer
	Maximum usage of renewable and local building materials of desert and minimum usage of building materials with the concentration of non-renewable energy, such as steel, brick, vinyl, aluminum and insulation
	Optimizing energy consumption and maximum usage of various forms of renewable energies especially solar energy in the desert
	Taking the excess energy of the building and storing it in the ground and even lower than that
Cultural – social	Considering the needs of the consumer in terms of his need of privacy and safety

design	Paying attention to human scales and human's size and dimensions in designing
	Flexibility in designing buildings in order to increase its lifetime and reducing the need to create new spaces and destroying useless spaces
	Ability of the building for promoting and adding future technology
	Formation of spaces based on cultural – social features and behavioral patterns of people of the desert in order to make the human relations stable
Economic design	Looking back and avoiding unnecessary things for increasing efficiency
	Using materials that can return to the natural cycle
	Making local materials of the region proper according to the new methods of living in order to reduce the costs and homogenizing construction of building with the surrounding environment
	Designing and building with long service life
	Standardization in construction by using proper
	Stability and strength of the building against environmental incidents

#### Conclusion:

In order to reach repeatable values in local architecture, a number of traditional houses in Yazd have been reviewed as an evidence of sustainable architecture. The reviewed buildings are sustainable, because they meet their own needs in terms of water and energy in their own site and not only are they compatible with their site and climate, but they also share the changes of the environment. They work without pollution and they don't produce any kind of waste that is not useful for another kind of building process or can't be used in the environment directly. They provide health and happiness of the residents in a unified ecosystem and lead to promotion of the environmental qualities as well.

In extracting values that shall be considered in formation of architecture, paying attention to repeatable values of local architecture is crucially important. The impact of these values in all of the three fields of environmental, cultural - social and economic sustainability can be reviewed. The basic point in understanding is the applicability of the extracted values in local architecture. Therefore, we can achieve a kind of architecture which would work as well as past architecture and continues the past architecture.

#### REFERENCES

- [1] Falamaki, Mohammad Mansour, 2007. Formation of architecture in the experiences of Iran and the West, Faza publication, Tehran.
- [2] Ghafari, Ali, 2003. System of establishment and form of architecture and urbanization in sustainable development (sample of the margin regions of Iran's desert), Saffe journal, issue 34, Tehran.
- [3] Pirnia, Mohammad Karim, 2004. Islamic Architecture of Iran, Publication of University of Science and Technology, Tehran, Iran.
- [4] Pirnia, Mohammad Karim, 2005. Stylistics of Iranian architecture, Memar publications, Tehran.
- [5] Tahbaz, Mansoureh, 2002. Principles of desert architecture, Saffeh journal, issue 32, Tehran.