

ECOLOGICAL DESIGN IN CITIES NEAR DESERT FRINGES: AN APPROACH TOWARDS SUSTAINABLE DEVELOPMENT

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ABSTRACT

A large number of cities in Iran are located in the desert margins. In the past, the cities have been designed and constructed based on the principles on Isfahan school and in compliance with the dry and hot climate. However, currently, they are faced with numerous problems both in the scale of the designed buildings and in the scale of skeletal space and physical organization. In terms of different factors such as urban landscape of buildings, plant diversity and reducing energy consumption, ecological urban design is seeking to combine the lost legacy of our ancestors in the urban climate design with the modern technologies of sustainable development. Ecological urban design is used both to control and direct the activities related to the cities development and to promote the urban environmental qualities. With the help of ecological approach in urban design, we can create opportunities for the production of ecological applicable systems through which one can integrate the natural processes, human activities and urban environment. This paper reviews the theoretical notions of sustainable urban design and the aesthetic and ecological analysis of old pictures related to cities located in the margins of the central desert of Iran. Survey data indicates that through such factors like the history of architecture and the native city construction derived from the Isfahan school and the emphasis on the environmental sustainability of cities, we can guide and improve our cities in conformity with their natural environment.

Keywords: *Ecological Urban Design, Isfahan School, Compact City, Iran*

INTRODUCTION

In the current era that ecological attitudes and approaches are considered among the most important topics in the world of sustainable development and land use planning, particularly in urban areas, The societies are faced with a growing human population and urban areas and the replacement of natural ecosystems with urban environments, it is predicted that by 2025, 65% of the world's population will be living in cities. With growing urban populations, large cities are faced with many problems such expensive land playing an important role in city development, land use changes and limitations in the development of green spaces and even replacing them with other land uses, particularly residential, commercial and industrial uses in the city and town borders (Ziyari, 2008). An increase in depletion of non-recoverable capital of natural resources and degradation of the quality and performance of natural ecosystems urban ecologists have found that in order to achieve the current real-world problem solution, focusing on the areas of human dominance that often include urban landscapes, seems necessary (Johnson and Hill, 2002). The rise of dynamic environmental changes caused by human activity in the dynamic environment and the rise of human dominance, have caused fragmentation of natural environments after which the focus on the ecologic concepts has grown out of isolation and protection of site and become and protection of ecologic networks (Jongman and Pungetti, 2004).

Today, there is poor understanding of ecological design. In fact, the issue of creating a healthy built environment is not a kind of problem -unlike the other issues- that could be solved using advanced technology. Many designers erroneously believe that if a building is equipped with enough mechanical devices to absorb clean energy such as solar cells and wind generators and other equipment they have quickly reached ecologic Design (Ziyari, 2008). But such an approach has major differences with ecological design. Ecological movement is different from engineering movement toward green design.

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MATERIALS AND METHODS

This applied research uses analytical - descriptive research methods. First, we become familiar with the concept and criteria of "ecological design" and consider the solutions to encounter the climate in the warm and dry areas of Iran without using the fossil fuels, then we will consider the aesthetics ecological aspects of traditional context of Tabas which is located in the margins of the central Iranian desert. Finally, the results and suggestions about stabilizing the design and urban images will be presented.

Ecological Design

Ecological design is a method of design that puts the human made structured in a healthy relationship with the natural environment and biosphere, in a way that the lowest risk is realized toward the ecosystem. The local characteristics of the environment are at the center of attention (McHarg, 2007).

Stuart Cowan & Sim Van der Ryn define ecological design as "the philosophy of physical objects' design, the built environment and services complying with the principles of economic sustainability, social and environmental". For the first time the prefix "eco" in 1998 was raised by John Button in ecological city, ecological management and ecological practices, Ecological Architecture. Initially, the nature of ecological design was summarized in adding Environmental factor into the design, but as it progressed, the details including production system or unique productions and industry were concentrated on as a general matter. Through the use of the cycling models in the energy and materials, the ecological design linked with different fields of issues in the industrial ecology (McHarg, 2007). Ecological design cannot be achieved unless it is guided by human activities so that natural resources are preserved for the posterity. Ecological design is emphasized on further reduction of energy waste in the environment, reduction of the production of harmful factors for human health and the use of renewable resources. However, the stability criterion in Architecture is formulated and should be directed toward developing criteria to use the minimum energy consumption, use of renewable materials, to maintain and reproduction of renewable energy without generating pollution (McHarg, 2007).

Ecological design saves biological species in urban environments, the existence of which is not only beneficial to human society but, it is crucial for urban fauna (Jongman, 2008)

Changes created by humans and urban structures have had great impact on environmental factors related to climate, groundwater aquifers, water, human life and biodiversity, and so the cities. With the development of cities, the number of species, size, and ecosystem integrity has been reduced and as a result the natural ability in creating new life has become low. Thus such a simplification can result in the loss of nature resilience which usually compensates the short and long-term changes such as climate change (McHarg, 2007). Ecological design has always believed that nature is the last pattern for all of the designs (Johnson, 2002).

A designer should expand his limited approach toward the nature in order to be able to include wider concepts of ecology in his projects. The built environment must be in the context of the surrounding ecosystem and this theory is heavily defended by ecologist. In the ecological design projects, regional ecosystems should always be considered as the units of global ecosystems, being made of all living and non-living components and forming an ecosystem (Forman, 1995) Ecological design, management is responsible for the effects of the built environment on ecosystems (Matlak, 2000).

A designer should know that all designed systems have one discharge such as open systems. These discharges enter into the surrounding ecosystem such as waste material in forms of solid, liquid or gas. In some cases, the discharges get back to the built environment and are recycled and used again. However, some materials had to be transported to the ecosystem again to be absorbed by the environment. A build system depends on its surroundings that are absorbing the waste. Thus, a designer cannot imagine that the waste can be suddenly and easily removed from the structure (Ziyari, 2008)

Objectives of the Study

The purpose of the ecological design is safe and gentle integrity with the environment. In fact, in the ecological design, processes and human activities have integrated with the broader patterns and physical

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desires of the nature; biosphere means all the livable places on the earth with have the potential to live in. This environment includes air (atmosphere, land and aquatic environment (Movaghatein & Shyrly, 2007). Our task in ecological design is to try to avoid deterioration and to make stable design for it. The ultimate effort in the ecological design is to restore the environment to the initial state before the damage and destruction caused by human activities.

The Main Goals of Ecological Design

- Achieving healthy environment in order to global stability and the quality of the local environment
- Achieving energy efficiency and symmetrical savings in consumption of non-renewable resources
- Maintaining biodiversity at all urban scales of production
- Achieving sustainable local and urban morphology using built environment (construction and transportation)
- Achieving social stability in the locations and interaction between generations and the social classes (Forman, 1986).

Measures to Obtain Ecological Design Purposes

The concept of a healthy environment: pollution control, natural resources management, environmental systems management, environmental impact assessment, monitoring, local environmental quality, landscapes enhancement, cultural heritage protection

In the category of energy efficiency: maximum efficiency and renewable resources, employing minimum non-renewable resources, appropriate technology in order to minimize waste, recycle and reuse.

In the context of Physical stability: stable construction (comfort and attractiveness), reviving building, recycling buildings, pollution control, waste management, landscape design, favorable ecological housing quality (durability, flexibility), designing by local nature, variety and mixing applications, preserving the historical identity, the proper density

In the context biodiversity: identification of vulnerable plant and animal species, natural succession stages, parks and natural habitat plan for the richness and diversity of landscape, creating green frontages and Wildlife Corridors, linking urban components and biological communities, public education and participation

The concept of sustainable transportation: safe and beautiful streets, desirable and easy accessibility, focusing development around nodes (Movaghatein & shyrlly, 2007).

Design and Architecture Ecological Solutions in Hot and Dry Regions of Iran

One of the sustainable symbols is Persian traditional architecture, that considers ecological issues and energy efficiency, which has been held accountable both in terms of low initial cost and low running and functional costs of building.



Figure 1: The compact city with narrow and irregular streets

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The study of hot and dry areas of Iran represents the number of matches that includes a wide range of urban design, housing design and selection of materials and components added to the building, depending on various conditions. We will discuss further about some of the methods adopted to achieve optimum heating and cooling systems and human thermal comfort in urban design and architecture using the environmental available energy.

1- In the urban design, coherence and integration of traditional buildings, narrow alleys and irregular context in the compact cities with narrow and irregular streets with high walls on both sides leads them to create maximum shade and keep sun exposure minimal. These spaces and elements provide the urban space with comfort and air conditioning.

2-Covering the sidewalks up, provides maximum shade at ground level which is observable in every corner of urban areas.

3-In designing the houses of hot and dry areas, enclosed spaces of central yard houses, have maximum shade. All sides of this house are built around a courtyard to get sunlight to create a variety of interior environments. Depending on the amount of sunlight, various sides of the yard can be used in different seasons. Usually the southern part of the yard due to be behind the sun and maximum shade are used in summer.

4-Green trees in Central yards increase Shades and, therefore, reduce heat, and in addition, the water evaporates because of the trees, and this increases humidity. This helps cooling internal spaces around the central yard. Also, due to the low specific heat capacity of air plants and trees within the central yard act as a natural cooling system and vice versa, thick-walled central courtyard has a high specific heat capacity and act as thermal storage that stores cold at night and gradually releases it in the middle of the day when the weather is warm. So, thick brick walls make small changes in temperature ineffective.

5-Traditional architects provided details like trunks and bumps in designs that maximize the shade.

6-The walls of the houses of Iran are about one meter thick in hot areas. High heat Capacity of clay causes the temperature to remain within the walls which means that small changes in temperature are ineffective. During the night, the walls lose heat through conduction and radiation and their temperature is kept low during day and provides plenty of comfort to residents. Thus, soil acts as thermal insulation.

7-Another solution for reducing heat absorbed by buildings, especially in hot, arid regions of Iran, is using arches and domes. This form besides being consistent with the materials available and structural reasons, in addition to having thermo physical reasons, is also good in reducing the transferred heat.



Figure 2: domes and arches

8- Selecting appropriate materials and wall thickness to achieve maximum insulation for interior climate are all specific solutions to hot and dry climate areas. The main building material in traditional houses, especially in their louvers, is the clay with 7 to 9 hours reaction time. Severe Thermal fluctuations in these

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areas, proves the stability of this material on the weather. Also, historic structures, particularly louvers enjoy, placement of bricks with high thermal capacity with a particularly low thermal capacity to achieve optimal weather conditions.

9-The most interesting materials are louvers which have been added solely for indoor thermal comfort. Louvers have always been amazing air conditioning systems and have been wonderful glowing example of Persian architecture compliance with strict requirements for natural water and air cooling system. Louvers in hot and dry areas are taller than louvers in hot and humid areas. Because in hot and dry areas high speed cool winds blow in high altitude, Conversely, in warm and humid areas, favorable winds blows down and leads the breeze into the coast.

Urban Landscape and Ecological Architecture in Cities near Desert Fringes

Beautiful landscaping in desert towns is always held under the architecture of the buildings. Watching the city landscapes arises questions in the mind. How the cities without dense green environment and forests with no modern towel look so beautiful to the travelers? What criteria have elevated the quality of the scenes like this? Here are some pictures of the old city of Tabas in the eastern margin of the central desert of Iran and we will discuss its ecological beauty architectural and urban planning details.

Which One is More Stable: Organic Cities or Compact Cities?

Compact cities are more successful in reducing the use of fossil energy for transportation and decrease in urban land and substructure use, but in terms of consistency with the concept of sustainable development the organic city is more advantageous. Organic cities are buildings that seem to have stuck to the ground with local traditional materials and have become consistent with landscape. The organic urban structure is non-geometric, the roads and streets are curved and the views are beautiful and hypertonic like postal.

The Predominance of the Natural Elements on the Artifact

A tree as a symbol of nature belongs to all human generations and the balance between nature on the one hand and constructions of the cities on the other hand must not change. Saving the tree has caused a shadow on the wall for the sake of comfort beauty. These trees can be used as a symbol or indicator for the residents of the surrounding area.



Figure 3: The alley's organic pattern provokes the sense of space Development and the tree is a symbol of respect for nature

Ecological Furniture

Conceptual image presented by the fans of the green movement today as "ecological furniture" and is recommended to reduce carbon emissions and avoid synthetic organic materials is seen in

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this old image of Tabas. Flowers and Clay are used to create benches and shade of the trees in addition to natural tranquility has provided a symmetrical beautiful scene.



Figure4: Ecological furniture

Live Wallpaper

Row of trees that have been planted in a good rhythm and shadow creates live paintings on the walls.



Figure 5: order of water and plants, in designing garden of desert areas

Water Order

Water presence in the built environment, whether in natural or man-made pathways in two forms of current water and stagnant water. Presence of flowing water is a symbol of flowing streams in the heaven and stagnant water represents a mirror which is the entrance gate to the virtual world (in accordance with the divine teachings of the Esfahan school).

Plant Order

The plant order means the surrounding nature and its coordination is as follows: externally with the presence of the plant when the plant is not present in space, copying the shape and color in the body of the accessories. And structurally copying the structure of the plant in the urban space, and conceptually the metaphor of paradise on planet Earth (Ahari, 1993).

The Effects of Urban Stress on Vegetation

A walking path in addition to the appropriate furniture, diverse vegetation and beautiful landscape should have the appropriate flooring which is consistent with the environment. Nowadays, street pavement and

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cement has surrounded trees and limited their access to air and water. On the other hand, since the soil is compact and has no proper drainage the surrounding trees are facing a shortage of oxygen and water.



Figure 6: Ecological corridors

RESULTS

Addressing the strategies in traditional architecture aimed at examining ways to assure compliance with the environment, especially in days that the human being inevitably had to use natural clean energy, is a lesson for the architects. Especially nowadays with the advancement of technology, the old days methods can be adapted to the needs and conditions of today's world and try to save the environment with the optimum and effective use of clean energy.

Thus, with minimal use of mortal fossil energies we can set a step to protect the environment for the next generation. Clearly, the pictures indicated "respect for nature" on the people and architect's side and Islam emphasizes on it too.

Conclusion

The main issue in contemporary architecture is the disconnection between the local architecture and modern needs. It is essential to remind the old methods as a symbol of green solutions and then harmonize them with the technology advances. Regarding the use of the natural resources and its potential effects on environmental elements, commissioning studies and Environmental Impact Assessment (EIA), particularly in relation to sustainable urban development, social impact assessment (SIA) is necessary. All cities, especially cities facing a severe problem in urban development should develop and adopt programs in accordance with national laws and regulations, the purpose of which is to deal with these issues and their development would promote systematic urban management into a sustainable path. In the tropical areas carefully selected materials, wall thickness, view design, designing appropriate locations of the house toward the sun, paying attention to favorable winds in the area and designing the elements that are guiding these energies into interior spaces, native architectural designs and even paying attention to the designs of large-scale urban planning and caring about the pedestrians a an actual way to achieve the goals of environmental sustainability.

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