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Impact of Hot and Arid Climate on Architecture (Case Study: Varzaneh Jame Mosque)

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Abstract

Generally, in architectural literature, scholars argue that there are lots of factors that affect on type of architecture. One of the most important factors is impact of kind of climate on architecture type. The purpose of this article is to evaluate the effect of climatic factors on construction and local architecture in hot and arid regions with special focus on Varzaneh city. A Jame mosque, which is the most important building in the city, is selected for case study. According to the findings in this study, this mosque was climatically designed in accordance with the economic and social context of the region.

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1. Introduction

How a building takes advantage of sun, breeze, vegetation, and creates a unique microclimate is one of the subtle but enduring measures of the designer's skill. Climatic design is the one approach by which to reduce the energy cost of a building comprehensively: the building design is the first "line of defence" against the stress of outside climate. In all climates, building built according to climatic design principles reduce the need for mechanical heating and cooling by using "natural energy" available from the climate at the building site. The resulting long-term energy cost makes climatic design techniques the best financial investment for any building owner. Many are "no cost" techniques, requiring only climatic design knowledge. Other techniques are easily incorporate into conventional construction [1].

Traditional Iranian architecture has changed a lot during different time periods, but architectural design respects nature in all durations. Lots of factors have an effect on traditional design, factors like religion, cultural and social issues, political decisions, the context of the city and climate and so on. In every climate, we have some positive and negative conditions. Traditional designers attempted to improve the positive aspects of climate to better the lives of inhabitants and confront with harsh conditions. Other goals of traditional architects were to maximize the conservation of resources (energy, land, water,

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materials) and reduce pollution. Most parts of Iran are located in hot and arid regions often face with limited water resources and green spaces but contain many ancient settlements. The design and construction of these settlements are based on the environmental issues from small details to the whole.

Many hot climates have a need for winter heating, which can be achieved by connecting passive systems for heating and cooling to the building. These are called passive plant and equipment because they use natural forces, such as temperature differences, radiation, convection and conduction, with no mechanical systems such as electric fans or pumps. The advantage of these systems is that they can be self-regulating and use no electricity; but they are often complicated to design since the dynamics of the systems are difficult to predict. A level of experimentation and empirical work is needed to optimize these systems. Active systems involve the use of mechanical devices such as electric motors and fans to drive heating and cooling systems. These can be used in combination with passive systems, creating hybrids.

Air-conditioning systems are increasingly seen as a part of the climate change problem, as well as its solution, as the yawning gap grows between the amounts of fossil fuels used in the world and the falling amounts of fossil fuels that are available to run these machines. Not only is the rising cost of energy a problem, perhaps least to those who could not afford air conditioning anyway, but the fact that the energy used to run these systems is a major contributor to greenhouse gas emissions. We now have no option but to adapt the actual fabric of our buildings to withstand higher temperatures [2].

This paper is done by the "case studies and combined strategies" research method. It uses analytical and description techniques, data collected from field studies and library documents [3].

2. Literature review

It could be said that birth of climatic design coincided with human development itself. Man's first shelters were caves, inside which the external conditions were tempered producing a high level of internal stability. Right back as far as prehistoric times, prehistoric man used his intuition to position his dwelling. As far as we can tell, he even seemed to use these dwellings to regulate some of the adverse effects of Nature [4].

Ancient builders were aware of the need for human-centered climatic design. Traditional building design took the climatic "given" as the starting point and derived not only building forms and practices but also generated cultural attributes. Over centuries, this-trial-and-error evolution was able to produce "traditional" design solutions that are climatically appropriate, culturally relevant and aesthetically pleasing. Unfortunately modern societies seem to have forgotten this art [5].

This type of architecture aims when designing obtain conditions of internal comfort, and so substantially increase our standard of living. This can be achieved by making the most of our surroundings, using climate, microclimate, positioning, winds, humidity and of course a good choice of materials to give us a personalized solution for a building integrated into its environment, cheaper, more pleasant and above all "healthier". Using only architecture and without any additional complex systems we can obtain a level of comfort which in many places would be sufficient without having to resort to using conventional, or in the best cases, alternative energy supplies [6].

So the architectural design of the building is one of the factors that affect the thermal comfort within. The architectural elements play a great role in influencing the thermal comfort of the building [7].

3. Climate of Varzaneh city

Varzaneh city, a small city on the edge of the central desert of Iran, is located southeast of Esfahan province. The origin of this city, which has the population of 13000 and an area of 2300 km², trace back to a pre-Islamic era. This city has been laboured sometimes during hot and arid weather in summer and sometimes during very cold winter [8] Fig. 1.



Fig.1. Varzaneh city (municipality of Varzaneh)

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