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Effect of 120-days wind of Sistan on the planning and designing of public spaces (Case study: The parks of the city of Zabol)

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ABSTRACT:

Weather conditions, along with other environmental factors are considered as one of the most important factors in the formation and development of cities and urban survival. In fact, cities, urban elements and their performance have been affected by the weather and climatic conditions. Wind has played a pivotal role in physical-spatial arrangement of old cities in the past. In this regard, the goal of the present research is the effect of 120-days wind of Sistan on the planning and designing of public spaces at the parks of the city of Zabol. The method of research is descriptive – analytic based on library and documentary studies. ELECTRE model has been used for analyzing data and field studies has been used for completing the research. The results showed that Mellat Park with the obtained weight of 0/60 and Yaqub Laith park with obtained weight of 0/16 have allocated the highest and the lowest weights. The results of ranking indices of parks showed that the indices of building places in the park at times of heat and sun, using windbreak in parks, the use of the right grass species in reducing energy consumption are preferred compared to other indices.

Keywords:
Designing, planning, 120- days winds, park, Sistan

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INTRODUCTION

The climate of every geographical location has its specific conditions. Meanwhile, it has also some restrictions on urban planning. It is necessary to consider the climate of the city and the observance of the criteria on the types of climate in addition to consideration of performance, visual and aesthetic quality in designing of different spaces of the city; buildings, lawns, roads, etc. Lack of attention to this issue create special problems in the cities (Shahamoardi, 2012).

Climatic design hierarchy in a region has an important role in the environmental comfort. This is more important in areas with specific climate. Among climatic factors, the wind flow has an important role in shaping the city form. Street orientation, height and density of buildings, distribution of high rise buildings, parks position etc., are some of the urban design elements that influence the wind flow patterns in urban spaces. Although the issue of interaction between urban design and urban wind flow from the 50s of the twentieth century has been attended by experts. But in Iran, despite rich experience in historic towns, this issue has not been well explored.

Despite significant impact of the wind on the shape and quality of urban spaces and residential tissue and the rich treasure of designing in harmony with the climate historic towns in hot and humid climate, it has not been conducted the compiled studies in this field and creativity of Iranian city in this area in a careful analysis is not clearly evident. This problem has led to the changes of urban planning and architecture in the historic issues on one hand, and on the other hand the scope of traditional knowledge based on wind flow is limited in designing the new cities.

Sistan region is one of the storm prone areas and it is located in the south east of Iran and in north of Sistan and Baluchestan province. In this area, there are more than 300 days of drought on average. According to the method, its climate is very hot and dry desert with dry summer and according to cluster analysis, it is with very low rainfall, warmth and dryness. Some of the important climatic characteristics of the region are: 260 days of wind in a year, sunshine, the high domain of the sun, large range of temperature changes during the day, the low average annual rainfall, inappropriately high temperatures and high sunshine hours (Raespour *et al.,* 2008).

In this regard, the city of Zabol in the north of Sistan area has its own conditions due to the specific climate of the region, particularly the wind climatic element, in which it is famous for 120-days wind or Loare and this has caused that the climate index necessary to be prominent in designing urban spaces.

So the goal of this research is the effect of 120-days wind of Sistan on the planning and designing of public spaces especially on the parks of the city of Zabol.

Goals

- Use of climatic elements in the design of public spaces, especially parks to create prosperity, security and comfort.
- Emphasis on undeniable important role of climate on urban design.

The history of the research

Ranjbar *et al.* (2010) in a research have studied climatic design and creativity proportional to the air flow in old issue of Bushehr. The results showed that urban spaces of Bushehr have been shaped by the hierarchy of climatic design proportional to local wind flow. Climatic design proportional with wind flow in the old issue of Bushehr has crystalized in some features such as location and setting of the high floors, the shape of squares and city streets, orientation of passageways and the cross-section passages in order to draft more, the shape of architectural space and its details.

Gandomkar and Fallahi (2014), in a research have studied the impact of the prevailing wind direction on the design of urban street network at the city of Saghez. The results showed that according to the type of

climate of Saghez and direction of prevailing wind of north - south with the highest scores compared to other directions, this direction is the best direction for city passages of Saghez, in the terms of sunshine and preventing cold winds.

Kasami (2006), has studied the effect of climatic factors on urban architecture and investigated the impact of environmental indices on the architecture and design of urban spaces extensively.

Hosaini (2003), has investigated the principles of designing with respect to the humid and mild climate in the city of Rasht.

Haghparast (1998), has studied the climatic factors of the area and the principles of natural geography at the regional level, and has implemented the principles of urban planning in the city of Ramsar.

Theories

Urban Design

Design is a part of the art of organizing physical space. Design deals with various scientific and artistic disciplines such as urban planning, architecture and landscaping, technical engineering, traffic engineering and transportation psychology, sociology and economy and at the same time, it is related to policy and culture. So we observe that its range of activities is very broad.

Razaghasl (2010), found out urban design and landscape architecture as two independent branches of science in architecture and urbanism that have been proposed during the last century, mainly because of the importance of the quality of public areas of cities and their surrounding areas. They also studied the overlap of landscape architecture and urban design in several areas:

- theoretical and practical commonalities
- occurrence of approaches between two courses
- the extension of the domain of two courses etc.

Urban spaces

Urban spaces concept explains the scene that the public activities of urban life takes place in it. Streets, squares and parks of a city are essential for human activities. In contrast to the fixed and immobile spaces of the residence and office, these dynamic spaces form the main and vital components of the life of a city and provide transportation networks, communication centers and public and recreation spaces in the city (Bahraini, 2007).

Streets and squares are the two main elements of urban spaces. The square is the first way use of urban space which are created by collection of buildings around the open space and street is the result of a set of buildings expansion that are located around the available spaces to square (Tavalai, 1993).

Public spaces

Public space in the city has always been the basis for periodic expression of cultural values and its shape has been changed based on the different social, economic and political conditions. These spaces are socially active because of its physical factors which can be grounds for entry and then stopping people into space and it can be appointed to some factors as: accessibility, visual attraction, natural factors and many other factors. But it is more effective than the physical dimensions in the presence of social interaction in anticipating and creating social events that it can be a ground to the sense of belonging to place in addition to opportunities for participating in social activities.

Basically, natural and climatic factors in Iran have had an important role in population settlement. These factors have provided social - economic conditions of population based on environmental conditions (in addition to modernization and scattering of bio centers) so that the image of cities and villages in Iran are influenced by the environmental conditions. Moderation in the quality of population settlement (apart from some geographic variable factors such as: the influence of decision makers and economic policy applied during the past decade) is affected by these conditions.

From the perspective of urbanists, urban public spaces are spaces that different individuals and groups

share in it, these spaces are a place for the exchange of ideas and information and a place for the formation of social networks. Such spaces are more than just a space but they are an experience, the results of such interactions and experiences among different individuals and groups will be a sense of collective identity, self-respect (self-esteem), improving social skills and community involvement. Such interpretation of urban space in relation to human social bubble since Aristotle, has always attracted the attention of urban planners and theorists and still is in progress (Douglas, 2003).

Climate and architecture

The subject of climate and architecture is one of the interesting subjects in the study of climatic factors on housing and human living space. As a result of experience, architects in the past have known the effects of wind and sun and rain on the houses and buildings and they have offered interesting ways to reduce the undesirable effects of these factors. In contemporary architecture, changes that emerges according to the bioclimatic and sustainability criteria, every day becomes more important. In fact, the ecology of building emphasizes on the building capabilities for integrating environmental and environmental factors and converting them to space qualities and comfort form.

Razjoyan, (1988) proposed a form that the role of atmospheric phenomena on human comfort was clarified separately. The relative temperature and humidity were the most important factors that due to their direct effect on human comfort, has been emphasized on them in Oleg bioclimatic table.

Gioni (1969) identified comfort zone and different bioclimatic conditions in relation to two elements of temperature and relative humidity. To determine the bioclimatic conditions and building needs, average of maximum temperature and the minimum of relative humidity was used (Kasmai,1993).

The wind

Sistan area is located at the route of atmospheric interactions between relative high pressure centers in the north east of the country and relative low pressure centers in the south east of the country and airflow is heavily influenced by these interactions. According to estimate of the number of days with dust and storm and for a period of ten years in the country, Sistan region with more than 1,500 days has received the highest proportion in the country. More wind directions are related to the northern and the northwest winds that allocate 80% of the total. Northern winds flow almost all months of the year but in the months of May to September they have greater intensity and speed.

The northwest winds also are observed throughout the year, but it is particularly in the months of June, July, August and September that their length, speed and intensity increase dramatically compared to other months. The speed of northern and the northwest winds sometimes reach from 70 to 90 and sometimes 100 to 120 kilometers per hour. The flow of northern and the northwest winds in the warm months of a year creates a phenomenon in the area that it is called "Loare" winds and we call it 120-days wind (Podine, 2012).

MATERIALS AND METHODS

The method of research is descriptive –analytic based on library and documentary studies. ELECTRE model (Asgharpour, 2010) has been used for analyzing data.

ELECTRE - TRI Model is among the families of multi ELECTRE to rank, for the first time and developed it later years. This method is a classification method for Multi Criteria Decision Making (MCDM) that classifies options based on pre-determined intervals. The classification is achieved as a result of comparing each option with profiles that represent the class boundary (Mousseau and Slowinski, 1998; Berger, 2002). As it has been shown in Figure (1), for the criteria of g_1, g_2, ..., gm (F set), profiles of b_1, b_2 ...., b_p (B set) will be considered

and if 'bh' is upper limit of 'Ch' class and lower limit of Ch + 1 class, h = {(1,2, ..., p)}, in this case there will be 'P + 1' classes. In this way, the relationship of Superiority (S) is established between the options and profiles. This relationship which is shown with 'aSbh or bhSa' means that option of 'a' is at least better than 'bh' profiles or vice versa. The threshold of indifference (q) and preference (P) form the information of superiority of any criterion. In fact, this amounts specify the accuracy of evaluating options for any criteria. 'qj (bh)' specifies the biggest difference of 'gj (a) -gj (bh)' that indicates the level of indifference between the option of 'a' and profile of 'bh' for criterion of 'gj', which represents the satisfaction level of option of 'a' and profile of 'bh' option for criterion 'gj'. Schematic representation of classes and profiles in TRI- ELECTRE method has been presented in the form of Figure (1).

For classifying Options, it is also necessary to calculate indices of similarities and differences (for every pair of option, each criterion and each profile for each criterion) (Mousseau and Slowinski, 1998; Berger, 2002).

Area of study

Zabol is located at the geographical coordinates 31 degrees' north. The extent of Zabol is 2084 hectares, which is equal to 0.13 percent of the area encompassing the city. Zabol in terms of land distance is 210 km from the Zahedan city in southeastern direction, 1538 km north of Tehran, 366 km North West of Birjand and 834 km from Mashhad and thus be associated with the centers of neighboring provinces and other parts (Figure 2).

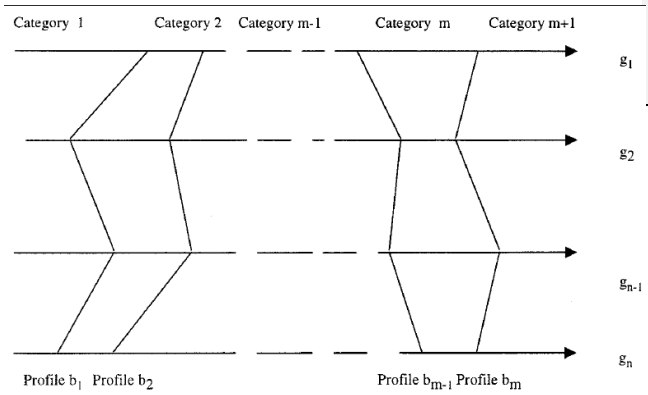

Figure 1: Defining categories of restrictions profiles using model ELECTRE

The divisions pattern of the city of Zabol

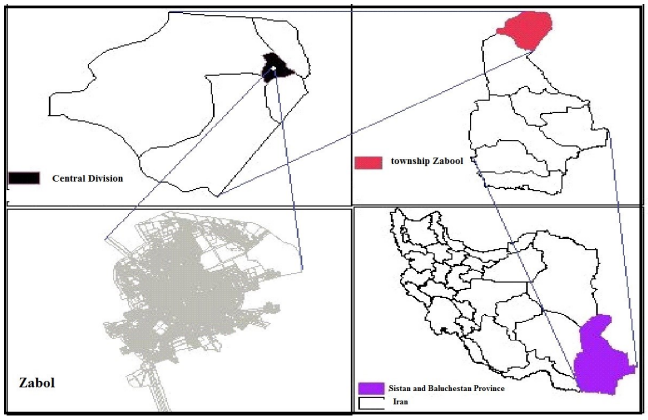

Figure 2. Position in the Area of study

According to the detailed design proposal, the city of Zabol has been divided into five regions and 38 districts. The region 1 has seven districts, the region 2 with 12 districts, each of the regions - 3, 4 and 5 has 7 districts.

RESULTS AND DISCUSSION

The core criteria's taken into consideration for the study are given in Table-1

The research findings

Table 1. The study indices

Sl. No	Study indices
1	Building places in the park at times of heat and sun
2	Using windbreak in parks
3	The use of the right grass species in reducing energy consumption
4	Use of small trees with small leaves to protect from moisture
5	Use of trees with larger diameter to create shade in parks

and the steps for conducting 'a' of research model

In this model it is assumed that the desirability of each dimension is steadily increasing or decreasing. Problem solving with this method requires few steps that makes us to refer to these steps seriously.

Based on this scales, qualitative criteria were measured and were converted into quantitative criteria and

Table 2. Conversion of qualitative to quantitative criteria

Region Indicators	Region 1	Region 2	Region 3
Building places in the park at times of heat and sun	8	8	6
Using windbreak in parks	8	7	6
The use of the right grass species in reducing energy consumption	9	6	5
Use of small trees with small leaves to protect from moisture	8	5	4
Use of trees with larger diameter to create shade in parks	8	4	3

Table 3. The square root of numbers

Region Indicators	Region 1	Region 2	Region 3
Building places in the park at times of heat and sun	64	64	36
Using windbreak in parks	64	49	36
The use of the right grass species in reducing energy consumption	81	36	25
Use of small trees with small leaves to protect from moisture	64	25	16
Use of trees with larger diameter to create shade in parks	64	16	9
Total	296	190	122

Table 4. Data obtained form the divided the square root method

Region Indicators	Region 1	Region 2	Region 3
Building places in the park at times of heat and sun	0.465	0.580	0.543
Using windbreak in parks	0.465	0.507	0.543
The use of the right grass species in reducing energy consumption	0.523	0.435	0.452
Use of small trees with small leaves to protect from moisture	0.465	0.362	0.362
Use of trees with larger diameter to create shade in parks	0.523	0.290	0.271

Table 5. Multiply numbers in matrix in the weighing of criteria

Region Indicators	Region 1	Region 2	Region 3
Building places in the park at times of heat and sun	0.074	0.348	0.131
Using windbreak in parks	0.074	0.304	0.131
The use of the right grass species in reducing energy consumption	0.083	0.261	0.109
Use of small trees with small leaves to protect from moisture	0.075	0.217	0.086
Use of trees with larger diameter to create shade in parks	0.083	0.174	0.065

Table 6. Determination of weight to the criteria

Region 1	Region 2	Region 3
0.60	0.16	0.24

its results has been reflected in Table (2).

In Table 3, the descaling of quantitative numbers of decision making has been done and in the Table 4, the obtained data from division of the square root has been obtained. In Table 5, multiplication of numbers of matrix in the weight of parks will be calculated to calculate the final weight.

Determining of coordinated and uncoordinated sets

At this stage (Table 7) all options are evaluated with respect to all dimensions and coordinated and uncoordinated sets will be formed.

Determine the uncoordinated matrix based on matrix V and it is obtained using (Table 8).

The results showed (Table 6) that region 1 with obtained weight of 0/60 and region 2 with obtained weight of 0/16 have allocated the highest and the lowest weights. These findings are matched with Kasami (2006) results.

In Table 9 and 10, the effective coordinated and uncoordinated matrix will be formed. The results of ranking indices of parks showed (Table 11) that the indices of building places in the park at times of heat and sun, using windbreak in parks, the use of the right grass species in reducing energy consumption are preferred

Table 7. Specification according to the coordinated matrix

Indices	Trees with larger diameter to create shade in parks	Use of small trees with small leaves to protect from moisture	The use of the right grass species in reducing energy consumption	Using windbreak in parks	Building places in the park at times of heat and sun
Building places in the park at times of heat and sun	0.84	0.84	0.84	1	_
Using windbreak in parks	0.84	0.84	0.84	_	0.40
The use of the right grass species in reducing energy consumption	1	1	_	0.16	0.16
Use of small trees with small leaves to protect from moisture	0.84	_	0.000	0.16	0.16
Trees with larger diameter to create shade in parks	_	0.16	0.16	0.16	0.16

Table 8. Specification according to the uncoordinated matrix

Indices	Trees with larger diameter to create shade in parks	Use of small trees with small leaves to protect from moisture	The use of the right grass species in reducing energy consumption	Using windbreak in parks	Building places in the park at times of heat and sun
Building places in the park at times of heat and sun	0.165	0.173	0.165	0	_
Using windbreak in parks	0.13	0.173	0.13	_	0
The use of the right grass species in reducing energy consumption	0	0	_	0.131	0.087
Use of small trees with small leaves to protect from moisture	0.091	_	0.13	0.131	0.043
Trees with larger diameter to create shade in parks	_	0.131	0.087	0.087	0.000

Table 9. Effective coordination matrix

Indices	Trees with larger diameter to create shade in parks	Use of small trees with small leaves to protect from moisture	The use of the right grass species in reducing energy consumption	Using windbreak in parks	Building places in the park at times of heat and sun
Building places in the park at times of heat and sun	1	1	1	1	_
Using windbreak in parks	1	1	1	_	0
The use of the right grass species in reducing energy consumption	1	1	_	0	0
Use of small trees with small leaves to protect from moisture	1	_	0	0	0
Trees with larger diameter to create shade in parks	_	0	0	0	0

compared to other indices. These findings are matched with Gandomkar and Fallahi (2014) results.

The results of the above study are corresponded with the results of Ranjbar *et al.* (2010). The results of the research showed that the climatic design in coordinate with wind flow in old texture of Bushehr especially in

Table 10. Effective uncoordinated matrix

Indices	Trees with larger diameter to create shade in parks	Use of small trees with small leaves to protect from moisture	The use of the right grass species in reducing energy consumption	Using windbreak in parks	Building places in the park at times of heat and sun
Building places in the park at times of heat and sun	0	0	0	0	_
Using windbreak in parks	1	0	1	_	1
The use of the right grass species in reducing energy consumption	0	0	_	1	0
Use of small trees with small leaves to protect from moisture	1	_	1	0	1
Trees with larger diameter to create shade in parks	_	0	1	1	1

Table 11. The final matrix

Indices	Rank	Loss	Win	Trees with larger diameter to create shade in parks	Use of small trees with small leaves to protect from moisture	The use of the right grass species in reducing energy consumption	Using windbrea k in parks	Building places in the park at times of heat and sun
Building places in the park at times of heat and sun	1	0	1	0	0	0	1	_
Using windbreak in parks	1	1	2	1	0	1	_	0
The use of the right grass species in reducing energy consumption	1	1	2	1	1	_	0	0
Use of small trees with small leaves to protect from moisture	0	1	1	1	_	0	0	0
Trees with larger diameter to create shade in parks	0	0	0	_	0	0	0	0

CONCLUSION

The effect of the 120-days wind of Sistan on public spaces with an emphasis on urban parks have been investigated in this research. First, using 5 indices (building places in the park at times of heat and sun, using windbreak in parks, the use of the right grass species in reducing energy consumption, use of small trees with small leaves to protect from moisture and use of trees with larger diameter to create shade in parks), three regions in the city of Zabol (Region 1, Region 2, Region 3) were compared. The results showed that the parks of areas of the city of Zabol have been designed and planed according to climatic factors with an emphasis on the wind.

SUGGESTIONS

- Planting of trees and plants periodically should not be in rows because it will intensify the wind flow.
- The establishment of the park buildings and monuments in the city of Zabol in direction of 45 degrees and acceptable directions of 30 and 15 northern degrees.
- The use of trees as windbreaks on the sides facing the wind.
- Design urban parks in spaces where its surrounding are open spaces so that the wind can be discharged easily.

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