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Improving the quality of Climate step towards sustainable urban environment (Case Study: Imam Khomeini Square of Birjand)

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ABSTRACT

Urban spaces are greatly important in the quality of urban life and help to strengthen social interactions between citizens, while the role of these spaces, i.e. where social interaction of citizen's takes place and culture improves in its context is declining in our country day by day. Obviously, quality of outdoor activities depends on these spaces. On the other hand, the quality of urban outdoors is intimately related to micro-climatic conditions in these places as part of its physical environment. Therefore, outdoor activities are also influenced by climatic conditions of these places. Architectural and urbanism study of recent decades shows that in spite of the rich experiences about the interaction of urban design and climatic issues in Iran, imitation of Western architecture and urbanism, besides inconsistency and in logical compatibility with the behavior and habits of people, causes increasing unnecessary consumption of fossil energy in buildings today. Ecological design also acknowledges the fact that all designs have a global impact, because ecosystems are interdependent (the principle of unity of the environment). Thus, the micro-Climatic environmental impacts (pollution, heat release, etc.) influence on surrounding buildings and subsequently the region and the world because of the binding between ecosystems. The present study is an attempt to achieve the main objective of this research i.e. to provide Climatic comfort in urban spaces by the use of documentary studies, to investigate the main elements affecting climatic comfort such as wind, sunshine and its working system in spaces, then to study the design of a case (Khomeini Shahr Square of Briand) to provide climatic comfort by emphasizing on the more radiation and sustainability based on the results obtained. Finally, a series of principles and guides conducting urban designers are represented to provide the climatic comfort and sustainability of urban spaces.
KEYWORDS: urban space, Climatic design, ecological sustainability, Climatic comfort, Birjand

INTRODUCTION

City and climate are two natural man-made systems that closely impact each other. Climate as long as communicating with human comfort is the result of factors such as: sun shine, temperature and humidity, wind and the level of rain. The climate of any geographical area has a specific condition that at the same time has specific constraints with regard to urban planning. In designing different urban spaces such as: buildings, green spaces, passages etc. in addition to attending to functional, visual and esthetic quality, attention to the type of city climate and preserving principles of climatic design is necessary. Providing thermal comfort in the spaces of human life is one of the main goals of urbanism and architecture compatible with the climate. In the meantime, providing comfort in outdoor spaces depends on understanding climatic and environmental conditions more than closed spaces. Because in indoor spaces comfort can be provided under any condition artificially by using mechanical instruments of cooling and heating. However, there is no such possibility in outdoor spaces. On the other hand, access to comfort in outdoors provides the ground for comfort in buildings' indoors because outdoors consists the wisdom of the surrounding area. So, in case of preserving the architectural principles compatible with the climate in outdoors, providing comfort in indoors is facilitated and there is a great deal of energy saving.

MATERIALS AND METHODS

In the present study, which is a qualitative research, much of the information on the theoretical foundations comes from library sources, and the references are singled out from among the most updated and authentic Persian and English articles and books relevant to the subject. The issues raised in the literature include climate, factors that affect site climate, building form and climate, environmental comfort, climatic design, wind, natural ventilation, sun and shade, which are the building blocks of this research. Then, based on the theoretical principles presented here

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and by considering the urban design process (identification, analysis, advancing the alternatives, choosing the preferred option), a case study on the topic of the current research is designed and analyzed.

Climate

Based on World Meteorological Organization (WMO) climate means the interpretation of a series of climatic conditions determined by the quality and evolution of a certain areas' weather. Climate as natural phenomenon has always been taken into account by urbanites and architects. The aim of Climatology is to investigate and determine the natural behavior of atmosphere and utilizing it to the benefit of people, almost all of human activities for the continuation of life circle is affected by climate either directly or indirectly. Throughout the history of architecture, designers have always sought to answer climatic conditions; even the so-called traditional architects of climatic design had exact and professional expression. Either within the buildings located in mountainous cities which are protected against wind and are facing south or within the plans of traditional central yard houses deigned to maintain night cold in the hot and dry area from which the design and form of buildings are derived (Ghobadian Mahdavi, 1993:18).

Climatic factors such as wind, humidity, temperature and radiation affect human body differently and disturb human comfort depending on their intensity. Proposing rules for designing man-made environments provides the possibility for using appropriate climatic factors with human comfort. On the other hand, preserving such rules is correlated with providing other biological needs. The issue of not-utilizing sunlight and being inappropriate to receive sufficient sunshine and shade, not blocking the weather flow in city and using wind in natural ventilation of houses and reducing weather pollution caused people to encounter physical and mental problems throughout the world in recent decades.

Features that affect climate Site

Topography

Height, tilt and skylight place should be investigated because air temperature, wind and rainfall will be effective in achieving solar radiation, (Koch, 2006: 17).

Height

The severity of sun ray enhances with the increase of height; because sun ray crosses the thin layers of earth atmosphere before reaching to earth. The converse occurs at night because the earth looses more heat due to shining to sky. This phenomenon leads to extensive fluctuations in temperature in higher latitudes (ibid.).

Tilt

Oscillation of direct solar radiation on a steeped surface is more than horizontal surface. Solar radiation depends on altitude and the direction of slope in relation to the position of the sun. So when the light comes on slopes facing different directions, the heating effect will be variable (Koch, 2006: 18).

Land cover and SPAD cover

During day the highest temperature is only felt above the earth. Overnight, due to evaporation and outgoing radiation, the opposite phenomenon occurs and the temperature near the earth surface is lower; i.e. the lower the altitude, the more sever the conditions would be. The natural cover of the earth balances hot temperature and fixes the conditions. SPAD and vegetation cover reduces the heat, conversely, artificial structures, buildings and pavement absorbs radiant heat, and raise the temperature. Generally, vegetation rather than rigid structures creates less turbulence (ibid.).

Water

Since the heat storage capacity of water is four times greater than the dry ground, both during the day and throughout the year, it will undergo lower range of temperature fluctuations. The difference between coastal and non-coastal sites in dry climates in which the difference in moisture and daily temperature range is high will be tougher (Koch, 2006: 20).

Building Density

In urban areas, the adjacent buildings are ghosting each other. This phenomenon may be lead to reducing the heat in the patronizing buildings. These buildings and paved areas also save or reflected heat and raise the ambient temperature. In large metropolises, this phenomenon is accompanied by heat emanating from human activities and will result in the heat island. It is noteworthy that crowded buildings, both below and above the canopy (the roof) create a micro-climate. In this case, the light cannot reach the ground; therefore, this affect achieved and lost heat (Koch, 2006: 22).

The form of the building and climate

The building can have a large influence on coordinating the climatic conditions and the adjustment of critical condition transformation of outside air into the building. To understand the role of regional thermal (temperature and intensity of sunlight) in the formation of buildings in the same area the proportion of importance of each climatic factor should be determined. But in general, cold air tightness of the building form and intensity of sunlight stretches it in an east-west axis. We should note that the best from of a building is the form which loses the least heat during winter and receives the least heat from the sun during summer. Therefore, square plan is considered as the best form of building. Despite having the largest volume, it has the smallest external surface. Of course this problem is not true about today's buildings with large windows. Oleg believes that determining the best form for these buildings regarding the impact of temperature and sunshine happens in the temporal conditions of the inner buildings' weather (Kasmaee, 2004:116).

Climatic design

As mentioned above, the mere existence of a city influences local climate and along with the city change, its climate also changes. Some urban design elements and features, such as: building density and city form can reduce energy consumption in urban areas and affect climate (Bulkeley and Betsill, 2003: 177). In general, the issue of climatic design is not too difficult to understand. Physical comfort of people in the building is achieved by thermal energy balance between us and the surrounding area. When the designer recognizes the local weather conditions, the principles of climatic design that fits the weather can be selected and compared (Watson, 1382: 4). Some elements and characteristics of urban design such as density and city form can reduce energy consumption in urban areas and influence on local climate. In addition, revitalizing outdoor spaces will lead to energy savings inside buildings. As people spend more time in outdoor spaces, the usage of air conditioners and other electronic equipment will be reduced (Lay, D, 2014, 715).

Environmental Comfort

Human body does not have separate sensor to understand the ambient temperature, and the temperature together with relative humidity, wind speed, solar radiation forms humans' perception from environmental conditions (Scudo, 2005, 259). Environmental comfort, satisfaction and comfort is the result of the coordination between aspects of physiological, psychological, and human body and his environment that includes a wide range of conditions for thermal, audio, visual, olfactory and esthetic comfort and air quality (Nikolopoulou, 2003). Each of these environmental factors affect the senses through variables such as cold, heat, sound and light which is the response to environmental stimuli determining the level of comfort either generally or as a single case. In fact, environmental conditions determine the primary indices of comfort. Research findings of environmental comfort show that although, the factors affecting the comfort do not have equal weights, most of them emphasize on thermal conditions as one of the most effective issues in the satisfaction of space and the important criterion of public comfort (Katzschner, 2006: 2). And calculating thermal comfort is assumed prior to visual and audio comfort as in some studies (Nikolopoulou and Steemers،2003: 97) by outdoor comfort we understand thermal comfort.

The main variables of comfort in urban spaces include climatic and individual variables. Effective climatic variables are temperature, air flow, humidity and temperature radiation (Givoni, 1976; Fanger, 1972) that radiative is one of the most important variables for assessing thermal comfort in outdoors. Because the temperature of the radiation on humans is multilateral, the average radiative temperature should be taken into account. In this regard, the average radiative temperature is the total of absorbed radiations by human body from different reflective surfaces (Mayer, 2008: 282). Other factors affecting thermal comfort, both indoor and outdoor, are culture and environmental approach of individuals, although in outdoor due to multiple interactions and multiple factors involved, the effect of culture is also crucial (Thorsson, 2004). In the past decade, a growing numbers of studies concerning outdoor thermal comfort have been conducted in various kinds of outdoor spaces under different climate conditions. For example, Spagnolo et al. (J. Spagnolo ,2003, 721-73)conducted investigations at a variety of outdoor and semi-outdoor locations in Sydney; Lin (Lin, 2009)in a public square in Taiwan , Kruger et al. (R. Emmanuel, 2012, 137-149) in a pedestrian area in Glasgow; Nikolopoulou et al. at a wide variety of locations in seven cities across five European countries; Xi et al. (xi, 2011) on a campus in Guangzhou; etc. These studies haveadvanced our knowledge of outdoor thermal comfort to a great extent. The large-scale field survey across five European countries (xi, 2011) confirmed a strong relationship between microclimatic conditions and comfort. Nikolopoulou et al. demonstrated that the physiological aspect alone is not sufficient to describe outdoor thermal comfort. There is also strong evidence of psychological or cultural adaption.

Wind and natural ventilation

One of the most important factors that influence the comfort of citizens in urban areas is the wind blow. In fact, from the standpoint of the impact of urban design on climate change and human thermal comfort, the greatest potential returns to wind conditions in cities. Ideal conditions for using wind in urban area is that in warm condition maximum winds is used for cooling and in cool conditions is immune against caustic winds. Since wind blow means movement of a mass of air having weights, speed and energy are more influenced by events on the ground compared to other climatic conditions. The rate of urban wind changes significantly by designing urban design factors such as orientation of streets, the height and density of buildings, dispersion of tall buildings, etc.

Speed, dynamic properties comfort and the motion of the wind cause thermal and dynamic comfort that these two factors are associated with individual characteristics of human. But, overall for the assessment of wind conditions regarding comfort or discomfort in urban spaces, factors such as geographical location, type of space, type of use or type of activity, weather conditions and physical conditions are considered.

Analysis of wind behavior in dealing with natural barriers:

The effects of local topography

In the topography of a hill, the wind-faced areas, received the more wind than the amount behind the wind. The windy side of hills suffered severe winds. The hills deflect wind when air moves down the slope, valleys can focus winds and create their own thermal winds (Koch Nielsen, 2006: 18).

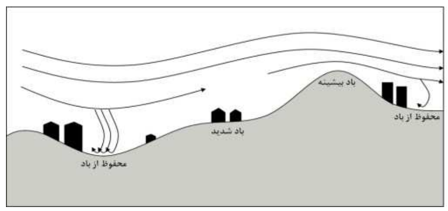

Figure (1) The effect of topography on wind flow Source: Author, based on Koch, 2006.

Natural barriers such as low hills and shallow valleys are generally soft and rounded corners and allow the winds to cross over them continuously and tangent on the surface. But man-made barriers that are generally rectangular and have sharp edges cause separation of the wind.

Study of two-dimensional wind behavior in dealing with individual barriers

When the air flow parallel to the ground faces this kind of barrier, at least three areas are created in which air movement is significantly different from the original and intact wind flow. These areas are near the barrier and to be back of wind, above it and far from the barrier in direction of the wind (Erell, 2011: 85).

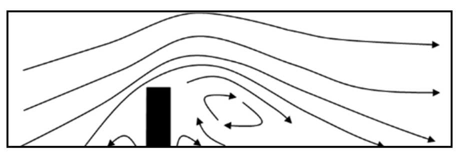

Figure (2): ***a pattern of airflow over a single and two-dimensional barrier. Source: Erell, 2011.***

The behavior of wind against hard barrier (wall, building and a raw of buildings)

Behavior of the wind in dealing with Disclaimer obstacles such as buildings varies in a complex way. Once, these obstacles are placed in the path of the wind, they influence parallel layers to the wind according to their size and shape. Diverted Layers after traveling back to the main path and return to its original speed. In this shift of ways, the areas are created with high pressure in front of the barrier and low pressure behind the barrier (Givoni, 2003, 18)

Soft and permeable barrier (vegetation)

Trees and shrubs are the most common natural barriers to regulate wind, but embankments can also sometimes be used as a carminative. Plant Carminative can be used to protect buildings and outdoors against cold and warm winds.

Three dimensional analysis of wind around the building

Buildings are three-dimensional structures and allow air flow to blow around their sides like their above. There are two distinct mechanisms (associated with pressure) that will disrupt the wind flow around buildings. These disorders lead to severe wind flows on the ground. The first type of flow is created pressure by distribution of pressure on the windy-side of a building that increases by height and is proportional to the local wind. The second type of flow is created due to the pressure difference between the low-pressure areas (lateral positions and back to the wind) and high-pressure areas, i.e. the lower side of the windy side. Flow between the two zones directly through corners around and hallways of the building can cause a huge increase in the local wind (Erell, 2011: 86).

Wind flow around high-rise building

The air after facing impermeable buildings deviates to three sides: above the roof, down the side facing the wind and sides of the building. The air that put pressure on building enforces relatively high pressure on the upper middle of the wall. This point is where the wind is interrupted and the pressure to the outside is reduced. This point is called the stagnation point (Erell, 2011: 87). Then, the flow of air from the stagnation point is distributed to the sides. Part of the flow passes over the roof and creates a small eddy flow in the area back to the wind. While a major part of the mainstream flow is transferred down into the wind-faced flow leading to increased small eddy wind currents back to the wind, created by surrounding short buildings and creates a severe eddy wind flow near the ground (Oke, 1987).

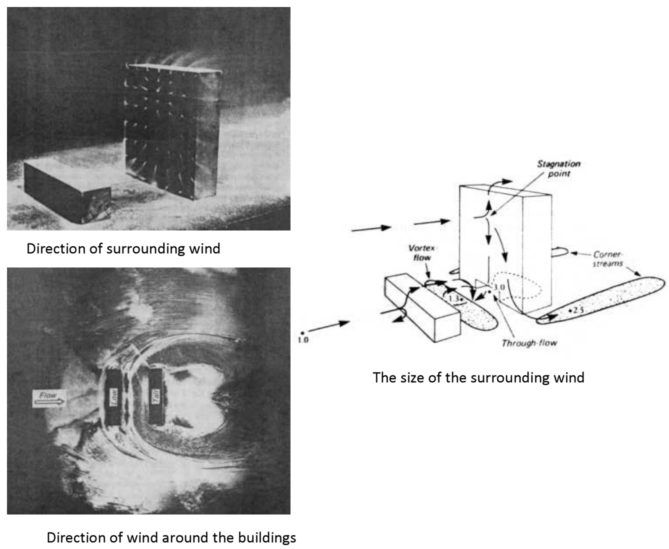

Figure (3): ***wind flow around tall buildings, Source: Abdullah, 2004***

Effect of wind on pedestrians
As mentioned before, analysis of the effect of wind around tall buildings and its related problems have been discussed by many authors. "Ynlsy" considered this issue in three parts:
• pedestrian comfort
• tall building
• surrounding area of tall buildings.
"Ayzyvmv" and "Davenport" by tall buildings on wind flow in the pedestrian movement is mentioned in the following cases:
• accelerate the wind flow near the corner of the building
• Reverse flow in front of the building
• disturbance in the back and edges of tall buildings
• Increase the acceleration of wind flow in confined spaces such as passages, porches and pilot
• funnel the wind flow in the spaces between the buildings.
Note that the relative comfort of a high or low wind speed depends on climatic conditions. For example, in a warm and dry climate, protection against the sun is more important than ventilation while in hot and humid climates it may be reversed. While in cold climates, protecting against wind may be the most important factor (Author, 2010, 25).

Sun and shade

The main features of urban space and its distinction from the inside is solar radiation in the space. The effect of radiation on the thermal comfort conditions in urban spaces has been confirmed by many studies and its important role is recognized. Human thermal comfort in urban spaces may be dependent on temperature as much as pedestrian's exposure to radiation. In addition to that our ability to control temperature in urban spaces is limited, although exposure to sunlight is rather simple at least regarding to the idea and concept. On the other hand the possibility to control radiation in summer (meaning shadowing) and in winter (meaning exposure to it) occurs by the physical design (Erell, 2011: 148).

The important point is to know that we cannot generally say when human comfort against sun is provided. Is provided when he is exposed to sun or not. For example, in projects conducted in the urban space of Sanfarnsico, exposure to maximum sunlight is the main factor in the success of that space, conversely in “first National Bank of Chicago” project the main factor in lack of success in the space and the users’ lack of satisfaction is insecurity against sunlight (Kermona, 2011:290).

Therefore, in this research since the main objective is designing urban space compatible with the climate and emphasis on the issue of radiation, in this section first the method of exposure to sun for passersby and urban spaces are studied and he related approaches to proving more sunlight in winter is presented and then the method to provide shade and shadowing methods are described in detail. In the following the design of urban block based on sun sheeting which facilitates access to sun and inactive warm and sun control and light of day for spaces is described.

A) Designing urban block based on sun sheeting

Morphology of an urban block in a typical form occurred based on factors such as land use, transportation and economic issues, environmental approach to block design with less energy consumption requires new guides. The concept of sun sheeting introduced by Knowls investigates the relation between energy and the city form and whether form can be a basis for guidance to access to sun energy in city block (Sarkar, 2009). When decisions are made by considering a period in which the level of radiation is desirable, limitations should be imposed on diagonal form to prevent shadowing of nearby buildings on areas of sidewalk that need sun (Erell, 2011:149).

Access to sunlight, has always been one of the factors shaping the urban form. This is evident in the architecture of native and a source of inspiration for many architects todays. Furthermore, access to sunlight turned into strict accurate criteria for contemporary urbanization conversion. Preserving the rights of shadowing is a necessary subject for urban design by which to be able to use warming energy of sun for buildings in winter and provide conditions for the people environmental comfort in city streets, Sidewalks and outdoors. Providing absorption of appropriate amount of sun energy is not simple. Most cities and countries around the world established rules to preserve rights of shadowing. The source of some of these rules are public perspectives in providing the maximum light absorption in outdoors and sidewalks. This issue is seen in cities such as New York, San Francisco, Toronto and Tel Aviv. In other cities, the reason for establishment of rules is the guarantee for shadowing of personal yards or installations and solar collectors. In this regard it can be said that the concept of sun sheeting is an analytical tool for city architects and designers. As access to inactive sun and hot and the daylight is made possible for spaces. In a city scale, sun sheeting means adjustment of development through assumed boarders which is derived from the relative movement of sun as the buildings within this sheeting cannot shadow the area around them. Sun sheeting creates necessities for designing and designers are encouraged to use different forms of city. Buildings’ direction of one side of street is different from the other side of it. For example, development of the southern side of street is less than the northern side (Watson et al, 2003: 1-4-6). Sun sheeting is defined as the total limitation of three dimensional shape manufactured on a site. As at a specific time of sun radiation no shadow is created on nearby buildings and site. In another definition by Knowles it is believed that solar sheeting means the maximum amount applicable to a specific site on adjacent sites shadow, thereby, to ensure enabling access to solar energy sites. Due to the size and shape of the solar sheeting regarding the size, direction and latitude, time of day that is favorable to access the sun and the favorable amount of shade on adjacent buildings and streets is varied. In simpler words, sun sheeting is an imaginary surface covering an area such as a roof and controls building shade-up and height (especially at certain times: 9 am to 3 like the afternoon or in the winter) (Knowles, 1981 : 51).

In fact, the solar cover do not vanish tall buildings but they will have scale effect on the city development. Density can be increased over time and based on common values, but the invasion to urban scale should be avoided. Solar cover is a moral and applicable obligation to use sunlight and form refer to it. This way, designers are encouraged to make difference in reacting to the Navigation resulted from sunlight and the city shape (Knowles, 353).

B) Techniques to access sun sheeting (geometric instructions for access to sun sheeting)

First technique: Knowles’ Techniques (angle cut method)

Knowles used solar radiation angle to define solar sheeting; these calculations is based on the intersection of four types of solar radiation that eventually creates a volumetric pyramid. The northern side of this volume is created by ghosting at noon of the shortest day of winter. The southern side is defined at noon of the longest day of summer. Eastern and western borders are calculated on the basis of daily sunshine and finally, these four borders provide a model for volumetric wrapping (Knowles, 1981: 54-55).

Second method: the structure of graphical geometry

This method depends on the solar angles resulting from intersection of the site with vertical surfaces generated by solar angles. Each level is created according to the sun azimuth and the angles of elevation between divided times. These criteria may be generated by sun or weather information (meteorological). Volume generated by these measures does not create a shadow behind the site with the dimensions 75 × 100 square meters, between 17-7 o'clock in summer and 9-15 in winter. In fact, at the beginning of the construction from 1-2 meters above the ground the volume can also increase. i.e. more shadows inclined to the nearby volumes are possible for a part of year.

Third method: digital assessment model 3

The way of locating site and geographical position are among the significant factors in defining this model. Over all, this method is more flexible and exact and gives designer more freedom to act compared to previous methods for providing a guide design (Ra & Morello, 1981:31.)

It should be noted that in addition to methods above, software such as ECOTECT و Energy Plass by taking local solar radiations result in solar sheeting.

Design of case study

Territory is a source used by tourism, this way the climate can be considered as a financial wealth for tourism (De Freias, 2003). Imam Khomeini Square of Birjand regarding its importance as link between different places in a city and by considering the position of this place in the main skeleton of Birjand and the social traffic role and its identity is taken into account by this research.

The necessity to turn this square to urban space along with removing irregularities are another reason for choosing this square. In the following figure, the position of Imam square in Birjand is shown.

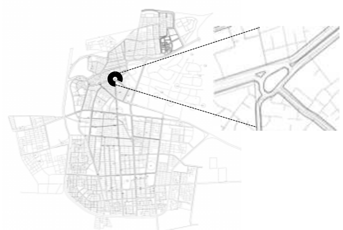

Figure 4: ***the position of Imam square in Birjand***

The area of direct intervention is considered this square up to a plaque around it. Imam Khomeini Square is the only square within its immediate area, this square which is more like the openness along Islamic Republic Street lacks the necessary element for the formation of an urban square.

Figure 5: ***Intervention zone***

Most of the applications were around the trade square which attracts a large population to itself during day. Most of these uses are service and the service providers are retailers.

Among the factors affecting the level of people's use of facilities, equipment of the square; the existence of sufficient facilities in the square including furniture, desirable light … caused people to present there.

From the physical point of view the square's wall is filled with masses and the square in the plane looks a positive space.

In explaining the functional layer, it should be noted that distribution of these functions is realized by following the detailed plan in form of business, administrative, cultural and parking (in the second layer of square wall) explaining that, identity applications are distributed in the way that with regard to the geometrical form of the square and the level of each application need to sun and shadow in each side is located. Therefore, religious-cultural application is located based on the need to Jelo Khan and a place for taking spare time and expectation in the entrance of the southern square which receives the least sunlight in morning and at noon.

With regard to the climatic condition explained the physical design should be done in coordination with climatic needs. Thus, the impact of climatic condition on building's direction and the green area is highly significant.

In order to control the temperature condition in the square and providing spaces in the comfort zone of people, first the required temperature for relief in the urban space for doing any activity (according to the following table) is extracted and accordingly the associated space is designed.

Table 1: ***The temperature and activity indicator, resulted from measuring in Kasel (Katzschner,2006).***

Activities	Thermal conditions required for the use of outdoor spaces	PET (Physiological Equivalent (Temperature° C)
Sitting	Gram	**30**
Calm activities	Hypothermal	**26-32**
Children play	Hypothermal	**24-26**
16-24	Neutral	**Social**
16-26	Neutral	**Light motion**
26-32	Hypothermal	**Purchase**
14-24	Relatively cool	**move**
12-24	cold	**Rush**
12-24	Relatively cool	**Gardening activities**
16-22	Neutral or cold	**Working outdoor**

Consequently, since the movement has a low thermal interval, in the first shadow of the square which is placed in its wall is designed. Additionally, for cooling this space the vegetation, porch and the water in the atmosphere and creating uneven floors that intensifies the blow is used. In the next layer, temperature range of recreational activities and sitting which cause increasing temperature is designed.

5-7 Three-dimensional design of city

Figure 6- ***Overview of urban space in Imam Khomeini Square***

Figure (7) - ***view to the urban space of the Republic street***

Figure (8) - ***view to the city from the north side***

4. Urban Design Guidelines (results)

The city is located in a specific geographic coordinates and therefore has its own climate characteristics. Furthermore, even in urban spaces in a city are also different micro-climates and where some considerations in micro-climatic design should be based on the micro-climatic conditions of the same area, representing a guidebook for urban spaces for providing climatic comfort in different urban spaces cannot be a comprehensive guide for all climates and spaces. Therefore, a guide document that can directly help all designers and improve the conditions for the urban space comfort is not possible. Unless for each particular city or place a guidebook is provided so to be helpful in designing all places with different climatic conditions. Thus, the author tried to represent a comprehensive and useful method to solve this problem according to the method of controlling natural effective factors on climatic comfort in urban spaces. It should be noted that urban designers in order to use this guide should recognize the necessities providing comfort in this place and accordingly for each interfering environmental factor decide to decrease or increase the factor and by referring to this guide choose the scientific approaches for increase or decrease the required factor to provide climatic comfort.

RESULTS (Guidelines)

- In order to provide the maximum protected length by herbal carminatives, the carminative width should not be more than three rows of three.
- If two or more rows of tree are used for the maximum use of the area's width we should plant shorter trees facing the wind and taller trees behind the wind.
- In order to prevent wind turbulent flow on walkway constructing tall buildings around urban spaces should be prevented.
- In order to provide comfort of pedestrians against wind we should prevent locating urban space near buildings taller than average height of around urban zone.
- In order to reduce falling eddy wind and improving conditions for comfort against winter wind tall buildings should have round corners and its narrow view is pro-winter wind or angular with respect to the wind direction.
- In order to weaken the impact of the sequence created by tall buildings, their height should be lower than twice the average height of buildings adjacent to wind.
- Buildings that is much taller than the buildings adjacent to wind should be designed in form of staircase. Withdrawal from the street edge to the building or tower should be at least 6 meters.
- To avoid wind turbulence on the walkway around tall buildings, it is recommended to design a large opening of the tall building in a higher adjacent building in an empty form.
- In order to control unfavorable winds within cities, the height of constraining buildings of the square should be shorter than the height of adjacent buildings.
- In order to prevent turbulent flows on the walkway constructing tall buildings around urban spaces (more than 25 meters) should be avoided as much as possible.
- In order to weaken the impact of sequence by tall buildings their height should be lower than twice the height of adjacent buildings.
- In order to conduct the wind to the walkway and reducing the temperature of city space and increasing the humidity, it is recommended to plant trees in urban spaces.
- The capacity of adjacent buildings of urban spaces should be based on geometrical instructions of access to solar sheeting as to provide solar expose to the space in the middle of the day.
- In order to access a combination of winter and summer needs associated with solar energy, after northern and southern passages, passages with intermediate direction have priority.
- In case of shadow passages, in these passages deciduous trees that increase the enclose of passage should be plant.
- In north-south streets in order to provide shade in the morning and afternoon, a canopy should be provided on both sides of the sidewalk.
- It is recommended to improve the thermal comfort in the squares colonnade be used all around the square.
- To conduct wind to the walkway and reducing the temperature of urban space and increasing the humidity, it is recommended to plant trees in the urban space.
- In order to improve thermal conditions in urban areas, the use of green walls in the pedestrians' surface is recommended.

- In order to reduce the thermal impact of walls on passerby, the passages for pedestrians should be at least one meter away from the wall.
- In order to reduce the impact of radiation on horizontal surface, the materials with light color on the passage should be chosen.
- Regarding the angle of sun radiation in winter, in west-east passages due to shade, the height of southern walls should be more than the passage width.

DISCUSSION

In this research a total of views, opinions and studies conducted so far about the research topic are studied and can be an appropriate source of the impact of climatic factors like wind, sun radiation on urban spaces. As it can be said that using this research all users of urban spaces who face problems derived from climatic comfort conditions derived from wind movements and solar radiation in urban spaces and or urban designers that this issue is considered one of their concerns can use this guide.

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